TRANSACTIONS

OF THE

EIGHTEENTH ANNUAL MEETING

OF THE

American Academy of Ophthalmology and Oto-Laryngology

HELD AT
CHATTANOOGA, TENN.
OCTOBER 27, 28, 29, 1913

The Nineteenth Annual Meeting of the American Academy of Ophthalmology and Oto-Laryngology will be held at Boston, Mass., Oct. 19, 20 and 21, 1914.

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PRESIDENT'S ADDRESS

JOHN W. MURPHY, M.D.
CINCINNATI

Ladies and Gentlemen and Members of the Academy: It is within the province of your presiding officer at this time to address you either upon some scientific subject pertaining to our specialties, or upon some subject closely allied with the welfare of the Academy.

This moment has been an anxious one to me for some months. To a certain extent we were inaugurating two experiments. First, we were going out of our well-beaten tracks and invading new territory in meeting so far south, and the question is often asked, will the members come so far to attend the meeting? The second was the change in the date of the meeting, over one month later than our usual custom. As I said, these were questions that perplexed your officers not a little. However, as I look around upon this magnificent gathering, I see how groundless our fears were.

One object of meeting in this city—Chattanooga—the pride of the South, was in the hopes of interesting your southern specialists in the Academy, and to try and induce them to join with us. To this end, I have sent out nearly five hundred letters during the year to Southern men, and I have been pleased at the prompt and hearty responses received. I feel that it should be the aim of each member of the Academy to add to the membership the names of those whom he knows to be worthy.

We are to-day the largest body of specialists in the country, our active membership numbering nearly seven hundred and fifty, and your secretary has applications for membership, for your consideration at this meeting, that will place us well over the eight hundred mark. This is our eighteenth annual meeting, and should this ratio be maintained for two more years, we should more than reach the one thousand mark set by my predecessor last year, for our twentieth anniversary in 1915.

I also wish to congratulate the Academy upon its most excellent financial condition. We have $3,424 in the treasury, and all bills paid to date. This has been accomplished in the face of the fact that a large proportion of the dues are given back to the

members in the form of the substantially bound volume of the Transactions, and the Indexes of Ophthalmic Literature and Oto-Laryngology, compiled by members of the Academy, and the further fact that our annual dues are much less than those of most other societies. It simply speaks volumes for the business-like methods of your worthy treasurer, Dr. Large.

The length of our program and the time at our disposal makes me jealous of every moment of our time, and I am anxious, therefore, to make my remarks as brief as possible, that we may the sooner begin the regular order of our program.

Meeting for the first time in this most hospitable of Southern cities, situated in the midst of so many decisive conflicts of the Civil War, the fiftieth anniversary of which was celebrated in your city only last month, we thought it fitting that one afternoon should be given up to visiting some of these historic places. To this end the local committee has made ample provisions for your entertainment, aside from the regular program. The taking off of an entire half day from our regular allotted time will make it necessary for us to husband our time, but by meeting promptly and working conscientiously, I feel that the program as arranged can be carried out without undue haste.

Those of us who have been fortunate enough to have our ladies with us will find that ample provision has been made for their entertainment during their stay in the city.

I wish to now publicly thank each of our invited guests, who have so cheerfully contributed of their wisdom and experience to our program. I also wish to thank each of the essayists for the generous manner in which they have responded to the call for papers.

The more than generous support given me during the year, by each and every officer of the Academy, has made my task a light one. I have enjoyed the work more than I can tell you, and I most sincerely thank you for the greatest honor that has come to me during my professional career, when you asked me to preside over the deliberations of this, the eighteenth annual meeting of the Academy, and in this most historical city.

THE SIGNIFICANCE OF THE SYMPATHETIC NERVE RELATIONSHIPS IN THE HEAD*

Wm. H. Haskin, M.D.
NEW YORK CITY

It is now a well-known fact that many cases of aural and nasal diseases cause distinct changes in the eye, and that most of these changes are either vascular or trophic in character. In a recent paper the writer attempted to group the many conditions noted in order to show the lack of appreciation as to just what changes were actually noted by the many observers.

As the anatomical relationships in these regions are becoming better understood, we are probably getting nearer the true solution of these conditions, and your president, having seen some of my specimens, has kindly invited me to address you in order to point out the relationships which appear to be most important. Many writers have described the relationship of the optic nerve to the posterior ethmoid cells and to the sphenoid sinuses. It should be remembered, however, that this nerve lies on the superior wall of the cells or sinuses in almost all cases, and that this wall is rarely ever bathed in purulent secretions in the sinuses, as the ostia of these cavities are always below the superior wall and are never actually closed. Also, remember that true optic neuritis never occurs unless there is meningitis or a post-orbital inflammation present also.

Professor Onodi and Dr. Sluder claim to have found actual relationship between the third and fourth, ophthalmic division of the fifth and the sixth nerves with the sphenoid sinuses. The writer has never found them, and believes that they must be very rare when the course of the nerves and the carotid artery in the cavernous sinus are carefully studied. All of these nerves enter the sinus wall external to the artery, and passing forward throughout its length, enter the orbit on the outer wall of the sphenoid fissure, through the common tendon of the orbital muscles. The artery enters the sinus at its posterior extremity and from below. It then bends forward and lies on the inner wall of the sinus until it reaches its anterior extremity, and then bends upward and pierces the dura at the anterior clinoid process. The position

* Read by Invitation.

of the artery appears to the writer sufficient evidence that the outer wall of the sinus does not touch the sphenoid sinus, consequently the nerves themselves are not in contact.

The relationship of the second branch of the fifth is, however, very frequently found, and is most graphically shown in the specimens presented. In them the sensitive branch, the motor

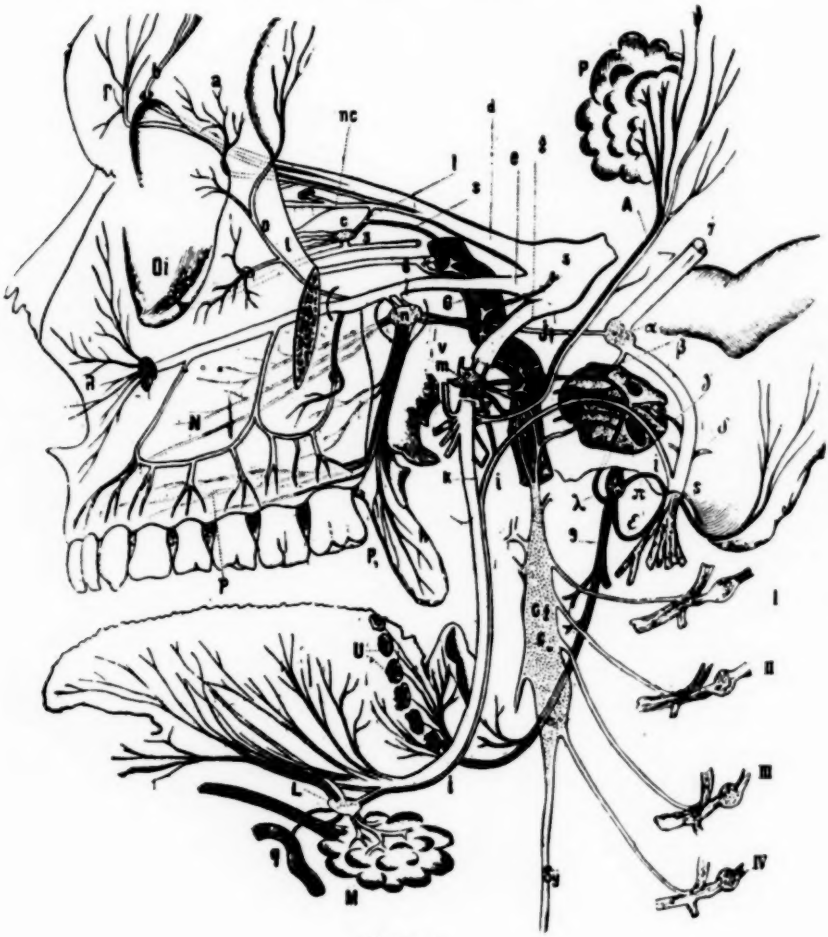

Figure 1.

and sympathetic, i. e., the vidian branch, and the spheno-palatine ganglion, are all shown in direct contact with the sinus. Such extensive relationships are not always to be found, but this branch is the one which is most frequently in contact with the sinuses. The third branch of the fifth is also found in contact when the

sinus has extended externally into the pterygoid wings as shown in the specimens.

To the above relationships, the writer has added that of the sympathetic nerve which, although described in all anatomical books, has never been noted in connection with its possible involvement in disease, although the majority of the ocular symptoms

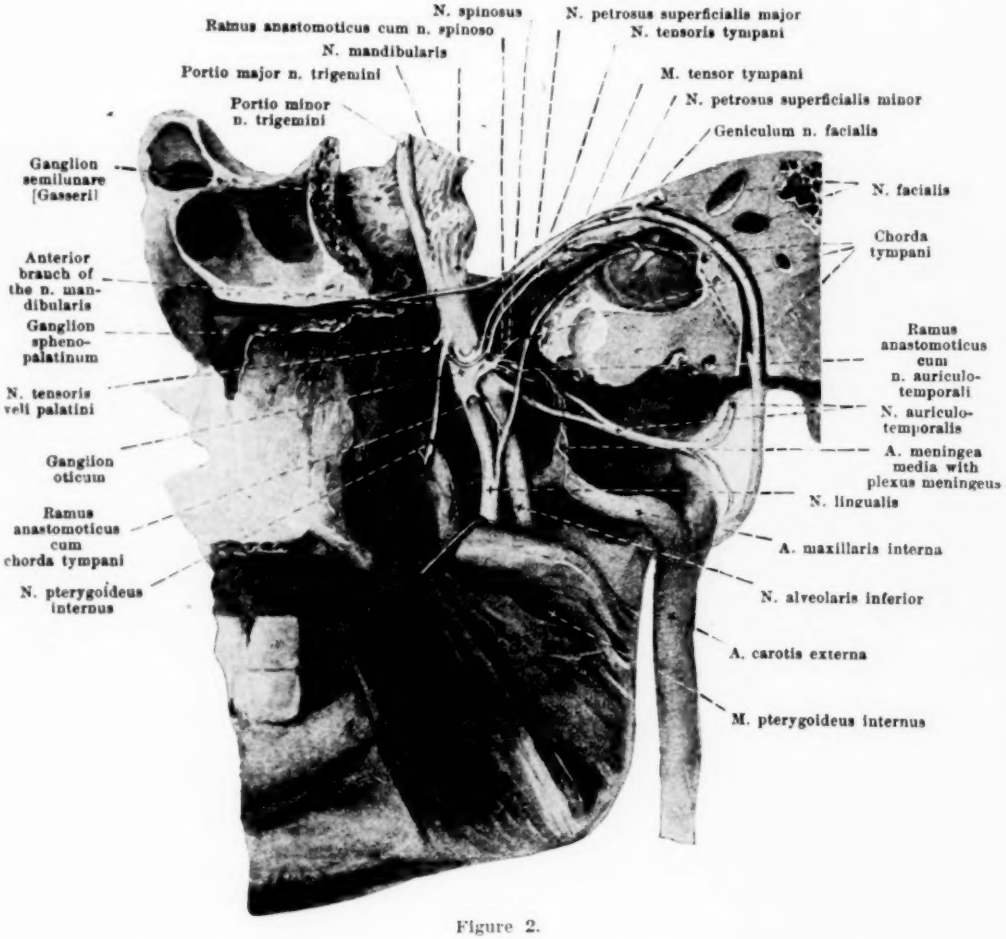

Figure 2.

described have been either vasomotor or trophic in nature, and point to some disturbance of this nerve.

The superior cervical ganglion, the largest of the three, and the one that is of interest to us, is placed opposite the second and third cervical vertebrae, and sometimes as low as the fifth.

It is in relation with the sheath of the internal carotid artery and the internal jugular vein in front, and lies on the rectus capitus anticus major muscle behind. Its branches are divided into superior, external, internal and inferior. The superior branch appears to be the direct continuation of the ganglion. It ascends by the side of the internal carotid artery, and entering the carotid canal in the temporal bone divides into two branches, which lie one on the outer and the other on the inner side of that vessel. The outer branch, the larger of the two, distributes filaments to the artery and forms the carotid plexus. The inner branch also distributes filaments to the artery, and continuing onward, forms the cavernous plexus. The carotid plexus lies on the outer side of the artery, and is in close contact with the middle ear. It communicates with the Gasserian ganglion, with the sixth nerve and the spheno-palatine ganglion, and distributes filaments to the walls of the carotid artery, to the dura mater, and also communicates with Jacobson's nerve, the tympanic branch of the glossopharyngeal.

The communication with the sphenopalatine ganglion is effected by the carotid portion of the vidian nerve, which passes through the vidian canal. In this canal it joins the petrosal branch of the facial, and crosses the floor of the sphenoid sinus, often being separated from the cavity by only the thinnest of bony walls on three sides. The cavernous plexus is situated below and internal to that part of the internal carotid which is placed by the side of the sella turcica in the cavernous sinus, thus lying on the outer wall of the sphenoid sinus. It is formed chiefly by the internal division of the ascending branch from the superior cervical ganglion. It communicates with the third, fourth, fifth and sixth nerves, and also with the ophthalmic ganglion, and distributes filaments to the wall of the internal carotid. The terminal filaments from both of these plexuses are prolonged along the internal carotid, forming plexuses which entwine around the cerebral and the ophthalmic arteries. Along the latter vessel, they pass into the orbit, where they accompany each of the subdivisions of the vessel, a separate plexus passing from the arteria centralis retina into the interior of the eye. The filaments prolonged on to the anterior communicating artery form a small ganglion, the ganglion of Ribes, which serves to connect the sympathetic nerves of the right and left sides. It is the only single ganglion belonging to the sympathetic system, all others being in pairs.

If we now take up briefly the physiology of the sympathetic, it at once becomes interesting in connection with our subject. The functions attributed to the cervical portion are as follows:

1. Pupil dilating fibers. Section of the cervical sympathetic causes contraction, while irritation causes dilatation of the pupil.

2. It controls the motor fibers for Müller's smooth muscle of the orbit.

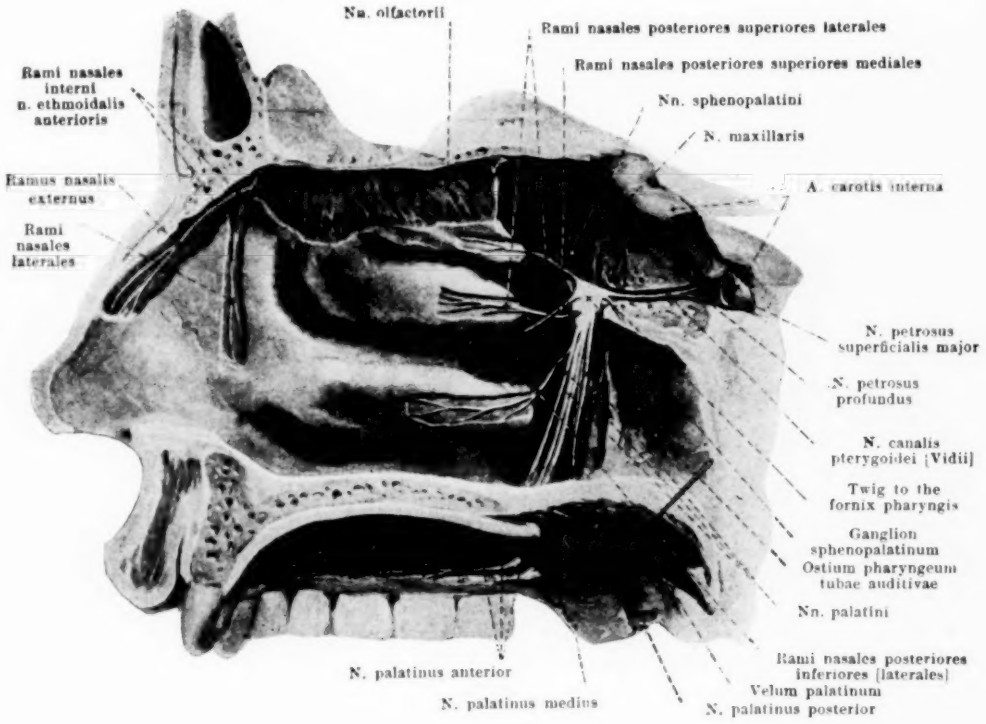

Figure 3.

3. It controls the vasomotor fibers for the outer ear and side of the face, the tympanum, conjunctiva, iris, chorioid and the retina.

4. Its trophic fibers govern the nutrition of the whole face, nerves, arteries, skin and all special organs.

5. It controls the sweat fibers for the head and the secretory fibers for the various glands.

The iris and retina also receive vaso-motor nerves from the trigeminus, and the ophthalmic division of the fifth contains

independent fibers for the dilatation of the pupil which arise in the medulla oblongata.

It is a rather significant fact that the four pairs of ganglia all belong to the sympathetic system, i. e., the ciliary, the sphenopalatine, the otic and the submaxillary, whereas the geniculate, the gasserian, the glossopharyngeal or petrosal and the ganglion of the vagus, belong to the group of the posterior spinal ganglia. Disease of these ganglia produces well-known and very characteristic symptoms.

With this short description of the relationships to guide us, let us proceed. In a paper read before the Twelfth International Otological Congress in 1912, Dr. Gruening emphasized the difference between optic neuritis and choked disk, stating that the latter condition can never be present if there is actual neuritis, and said that "further confirmation that we have not to deal with inflammatory action and destruction of the nerve tissue in choked disks of otitic origin is supplied by the fact that on removal of the purulent area the optic nerve returns to normal." The same confirmation is also true in the majority of cases associated with nasal diseases. Is it not significant when we recognize that the ophthalmic branches of the fifth, third, fourth and sixth nerves are not in contact (or if so, that the contact must be very slight) with the diseased cells or sinuses, whereas the fibers of the carotid and the cavernous plexuses are in intimate contact with these areas, and that they are the vasomotor and trophic nerves, the pupil dilating nerves and those which control the unstriped muscles of the eye and the orbit and they all belong to the sympathetic nervous system? The delicate fibers of this system are undoubtedly much more exposed to any toxemia or inflammatory action from these sinuses, and further proof of their probable involvement being the cause of many of the symptoms can be obtained by referring to the physiological studies, which show that all of the symptoms have actually been produced by experiments on these nerves. Dr. J. D. Richards described two cases of pupil dilatation following extensive exenteration of the petrous bone with exposure of the carotid artery in its canal, and attributed the dilatation to irritation of the carotid plexus, and the writer has recently seen two other similar cases.

Although all writers maintain that choked disk is always caused by increased intracranial pressure, in most of our cases there is absolutely no other symptom of this condition present, and it is certainly remarkable that in most cases the eye symptoms

clear up after the local aural or nasal disease has been relieved. Again, it is a very significant fact that in many cases, where operation has cured the nasal disease and the eye symptoms have disappeared, an acute exacerbation will often be accompanied by a return of the eye symptoms, which again disappear with the cure of the attack. True paralyses of the orbital muscles are rarely seen in diseases of the sphenoid sinuses or ethmoid cells

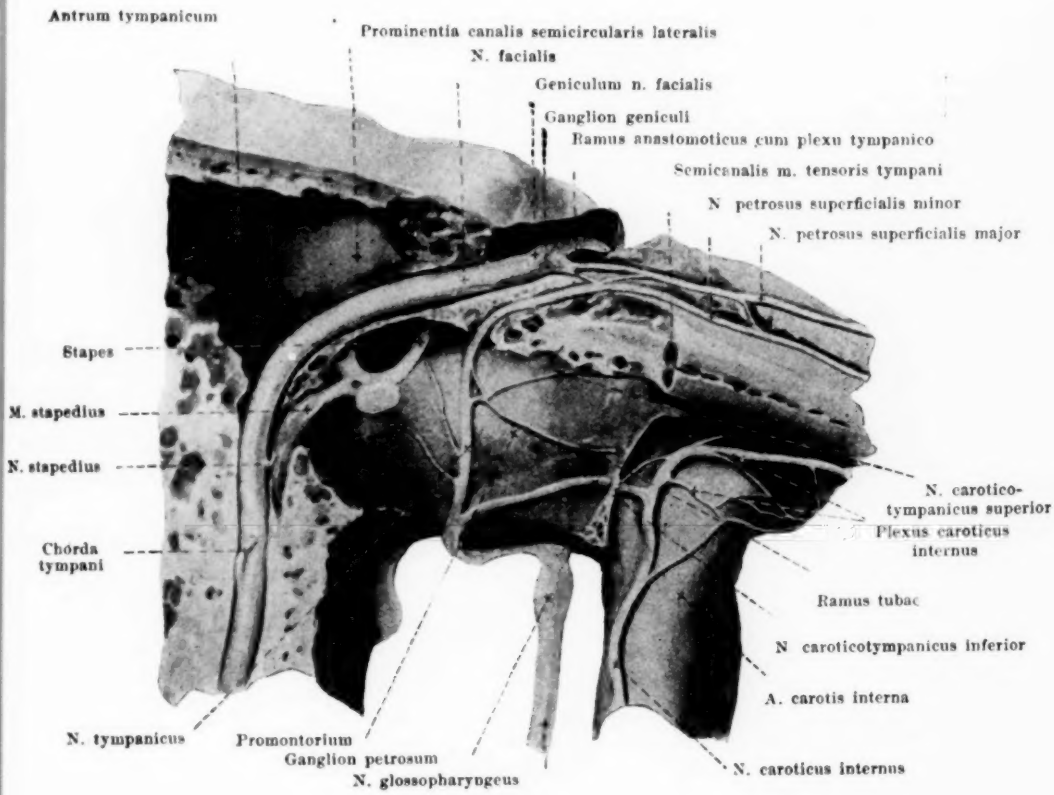

Figure 4.

unless they have caused post-orbital abscess. Paralysis of the abducens is being recognized quite frequently of late, and it is interesting to note its relationships in seeking for an explanation. The sixth nerve, as it pierces the dura, appears to enter the inferior petrosal sinus and continues on with it into the cavernous sinus through which it passes, lying on the external wall of the carotid artery. Any septic inflammation or clotting, extending

from the lateral sinus or jugular bulb or the cavernous, would probably cause this nerve to become involved. As paralysis of this muscle will not be noted unless specially looked for, it has probably often been overlooked in cases where its involvement might prove to be a very valuable help in diagnosis.

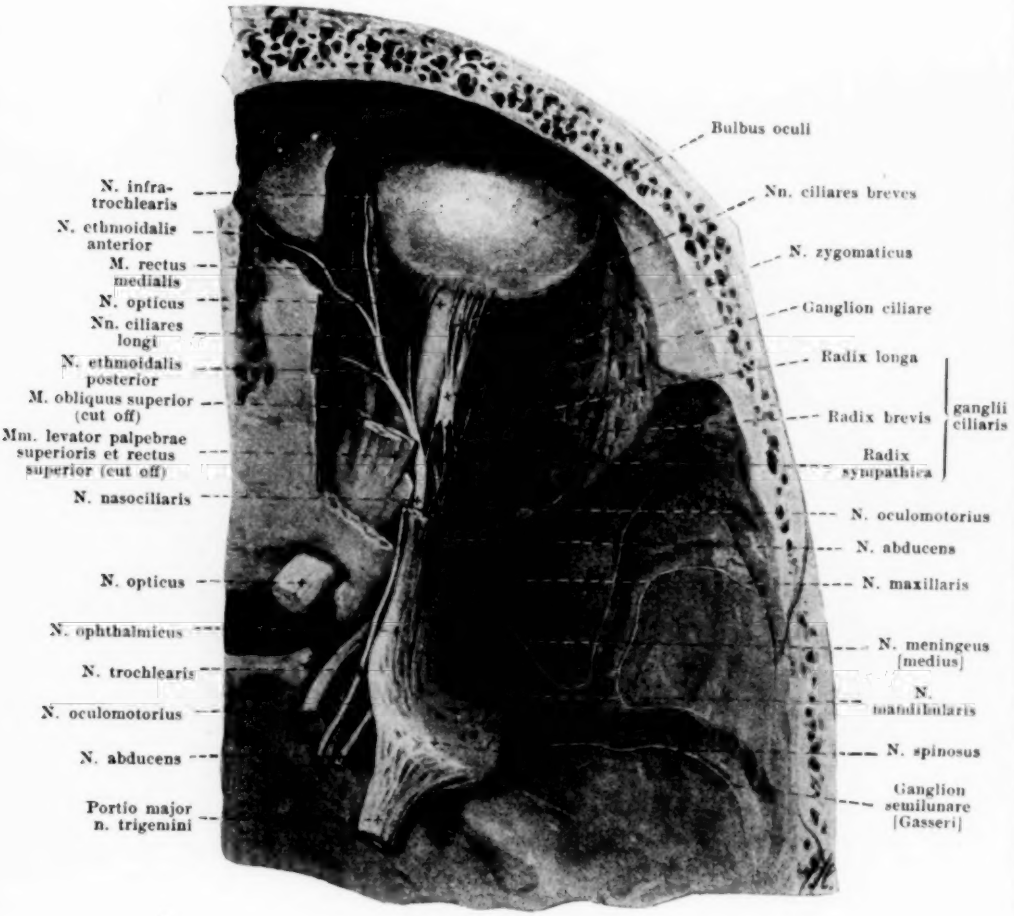

Figure 5.

Dr. G. Sluder has written extensively concerning the neuralgic syndrome of the sphenopalatine ganglion, and has undoubtedly been very successful in its treatment. It seems remarkable, however, that another member of our profession has discovered forty-six cases of this nature in his practice within two years. The question arises, what is neuralgia? It is not a neuritis, but the

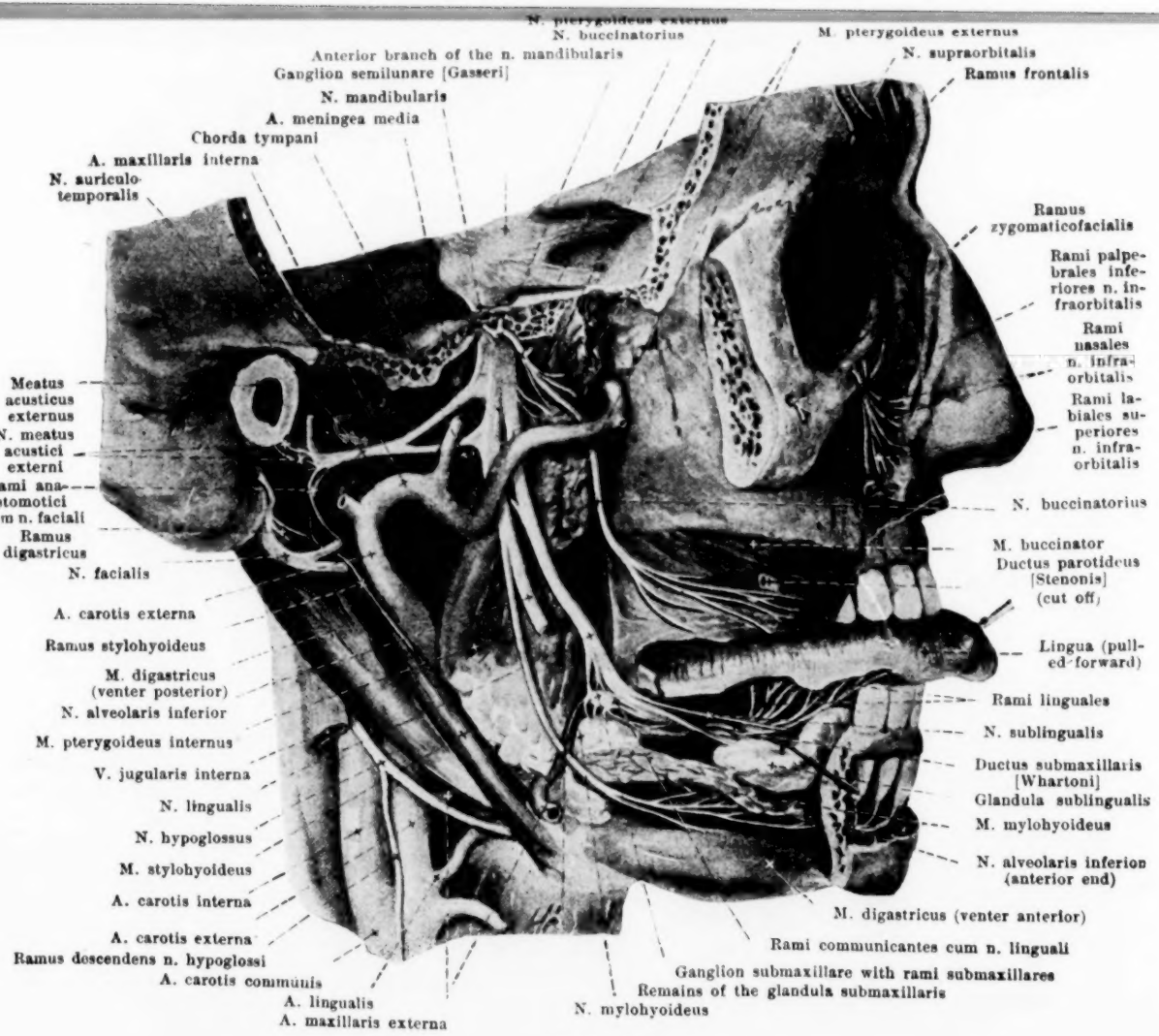
N. pterygoideus externus
N. buccinatorius
M. pterygoideus externus
Anterior branch of the n. mandibularis
N. supraorbitalis
Ganglion semilunare [Gasseri]
Ramus frontalis
N. mandibularis
A. meningea media
Chorda tympani
A. maxillaris interna
N. auriculo-temporalis
Ramus zygomaticofacialis
Rami palpebrales inferiores n. infraorbitalis
Rami nasales n. infra-orbitalis
Meatus acusticus externus
N. meatus acustici externi
Rami labiales superiores n. infra-orbitalis
Rami anastomotici cum n. faciali
N. buccinatorius
Ramus digastricus
M. buccinator
N. facialis
Ductus parotideus [Stenonis] (cut off)
A. carotis externa
Lingua (pulled forward)
Ramus stylohyoideus
M. digastricus (venter posterior)
Rami linguales
N. alveolaris inferior
N. sublingualis
M. pterygoideus internus
Ductus submaxillaris [Whartoni]
V. jugularis interna
Glandula sublingualis
N. lingualis
M. mylohyoideus
N. hypoglossus
N. alveolaris inferior (anterior end)
M. stylohyoideus
M. digastricus (venter anterior)
A. carotis interna
Rami communicantes cum n. linguali
A. carotis externa
Ganglion submaxillare with rami submaxillares
Ramus descendens n. hypoglossi
Remains of the glandula submaxillaris
A. carotis communis
N. mylohyoideus
A. lingualis
A. maxillaris externa

Figure 6.

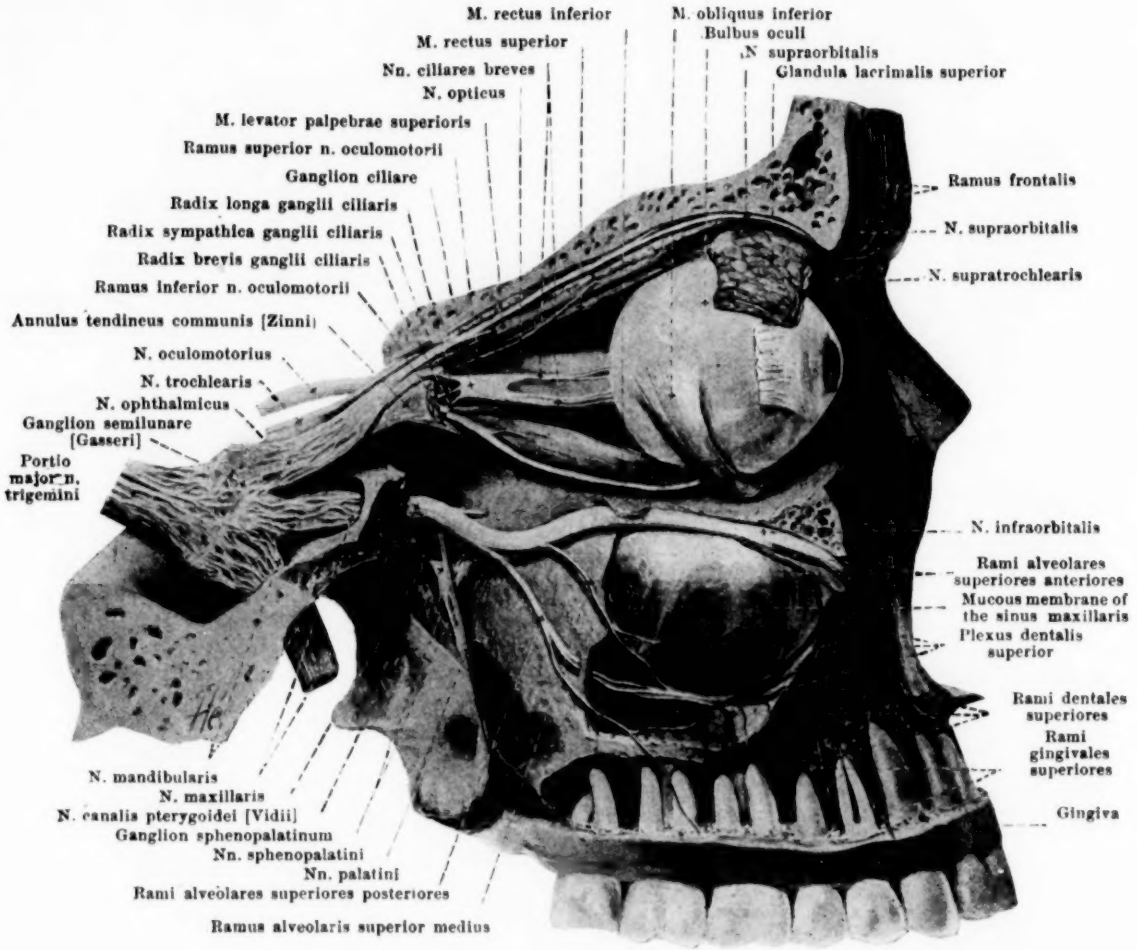
M. rectus inferior
M. obliquus inferior
M. rectus superior
Bulbus oculi
N. supraorbitalis
Nn. ciliares breves
Glandula lacrimalis superior
N. opticus
M. levator palpebrae superioris
Ramus superior n. oculomotorii
Ganglion ciliare
Ramus frontalis
Radix longa ganglii ciliaris
N. supraorbitalis
Radix sympathica ganglii ciliaris
Radix brevis ganglii ciliaris
N. supratrochlearis
Ramus inferior n. oculomotorii
Annulus tendineus communis [Zinni]
N. oculomotorius
N. trochlearis
N. ophthalmicus
Ganglion semilunare [Gasseri]
Portio major n. trigemini
N. infraorbitalis
Rami alveolares superiores anteriores
Mucous membrane of the sinus maxillaris
Plexus dentalis superior
Rami dentales superiores
Rami gingivales superiores
Gingiva
N. mandibularis
N. maxillaris
N. canalis pterygoidei [Vidii]
Ganglion sphenopalatinum
Nn. sphenopalatini
Nn. palatini
Rami alveolares superiores posteriores
Ramus alveolaris superior medius

Figure 7.

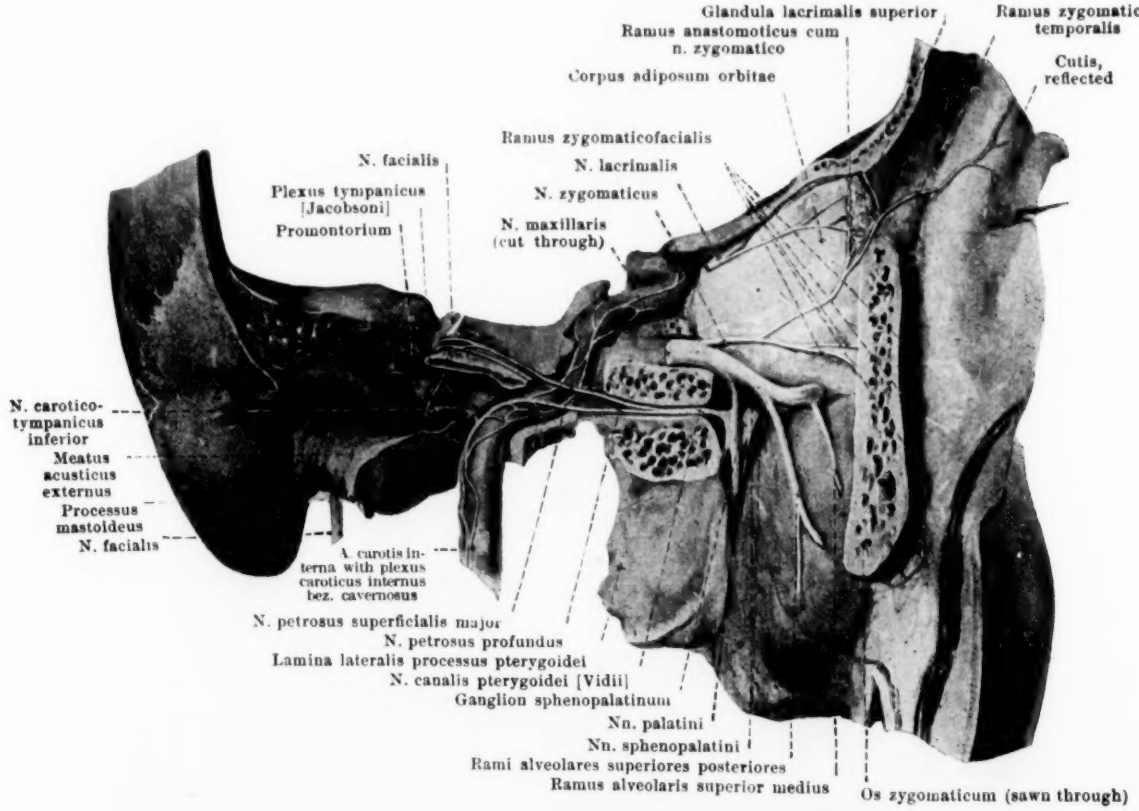
Glandula lacrimalis superior
Ramus anastomoticus cum n. zygomatico
Ramus zygomatico-temporalis
Corpus adiposum orbitae
Cutis, reflected
Ramus zygomaticofacialis
N. facialis
N. lacrimalis
Plexus tympanicus [Jacobsoni]
N. zygomaticus
Promontorium
N. maxillaris (cut through)
N. carotico-tympanicus inferior
Meatus acusticus externus
Processus mastoideus
N. facialis
A. carotis interna with plexus caroticus internus bez. cavernosus
N. petrosus superficialis major
N. petrosus profundus
Lamina lateralis processus pterygoidei
N. canalis pterygoidei [Vidii]
Ganglion sphenopalatinum
Nn. palatini
Nn. sphenopalatini
Rami alveolares superiores posteriores
Ramus alveolaris superior medius
Os zygomaticum (sawn through)

Figure 8.

pain arises from some disturbance of the nutrition of the nerve itself, and this again brings us back to the sympathetic nerve which controls the blood-supply of the nerve through the vasomotor filaments, and the nutrition of the nerve through the nervi-

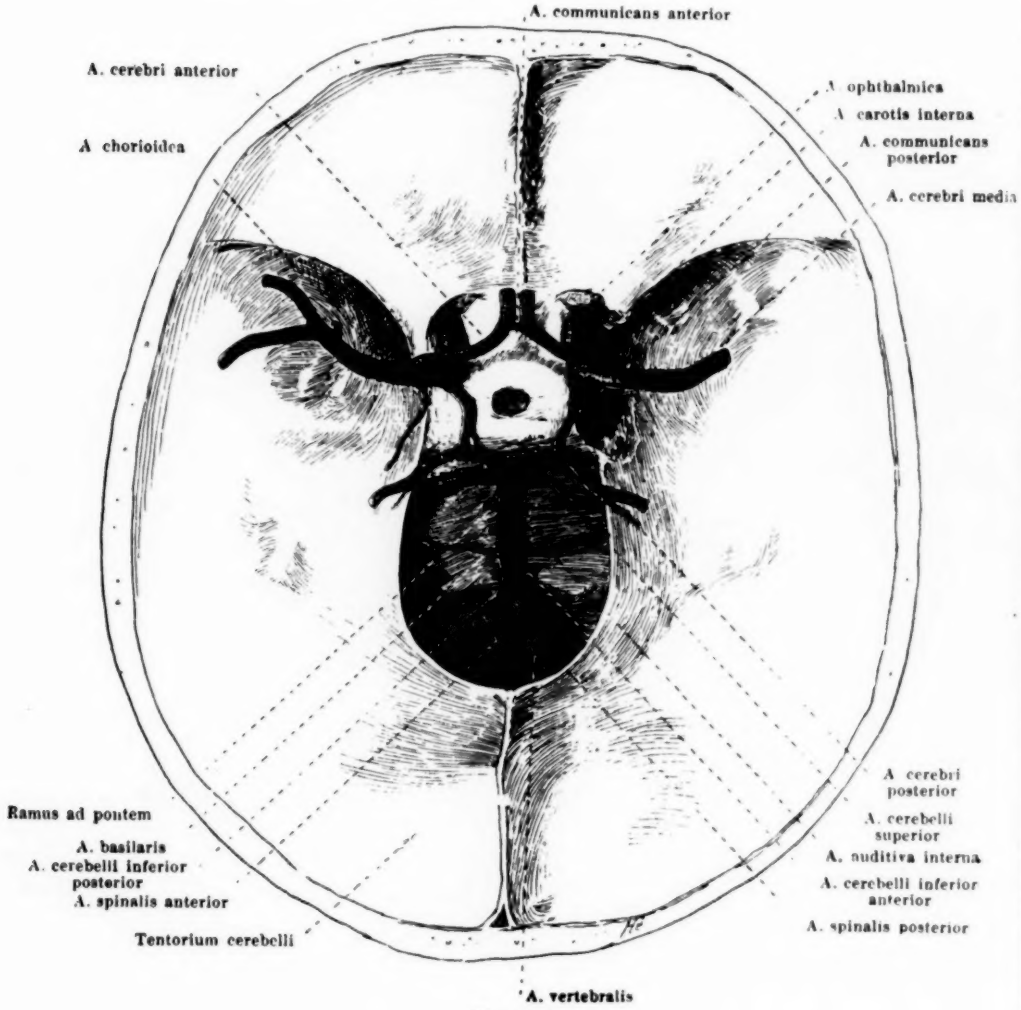

Figure 9.

nervorum or trophic filaments. In 1900, Dr. J. Termier of Lyons, France, published a most interesting book on the "Surgery of the Sympathetic in Neuralgias and Painful Syndromes." He reported twenty-eight cases of long standing and intractable cases

of neuralgic conditions affecting the lower limbs, the abdominal pelvis, the upper extremities and the face. Of these, ten were cases of trifacial neuralgia which had received prolonged treat-

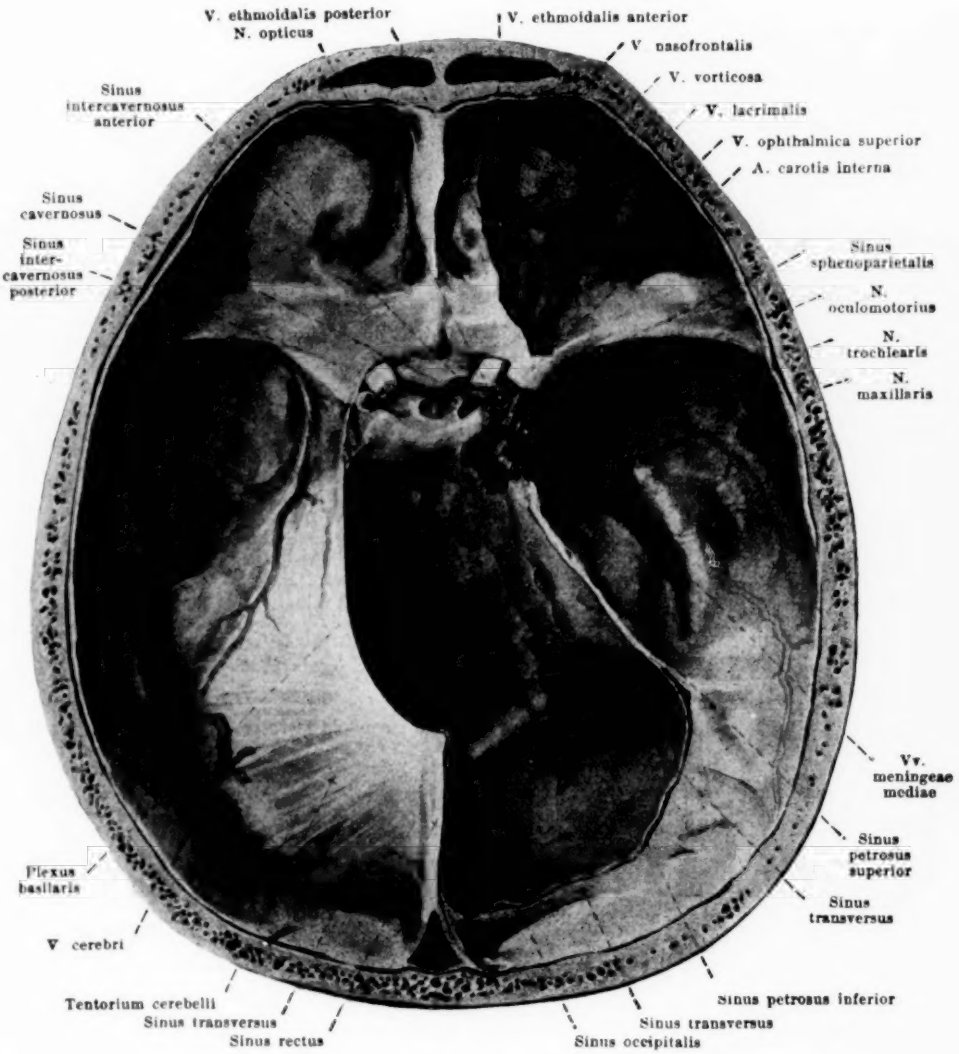

Figure 10.

ment, and many of them had had resections of one or more branches. Seven of them were absolutely relieved of their pain, and the other three were greatly benefited after resection of the

superior cervical ganglion. He called attention to the singular fact that the cure did not take place immediately after the operation, but only after a period of time varying from fifteen to thirty days. The crises began to lessen within two days, but did not entirely disappear until later. He argued that this probably showed that the ultimate cure was due to the loss of function of the nervi-nervorum, this producing a gradual atrophy. These cases are cited merely to show that the sympathetic nerve plays an important part in neuralgic conditions, but not to advocate the operation.

An exhaustive study of the relationship between the sympathetic nerve and diseases of the eye was published in 1904 by *Jour. A. M. A.*, in the form of a symposium. The writers were Drs. de Schweinitz, Wilder, Ball and Weeks. They covered the ground most thoroughly so far as the superior cervical ganglion and ciliary ganglion were concerned, but made no mention of the possible involvement of the nerve between the cervical ganglion and its ultimate destination, which the writer believes is the rational point to seek for the explanation of many of the symptoms.

Glaucoma has been observed by Lapersonne and Fish as a result of accessory sinus disease, and Sluder has relieved the pain in glaucoma by cocainizing the sphenopalatine foramen. The symposium referred to above reported extensively on the relationship between the sympathetic nerve and this disease, and reported a number of cures resulting from resection of the superior cervical ganglion, although the percentage was not large. This disease is one that causes an increase of intra-ocular tension due to some vasomotor disturbance, and has been produced experimentally by irritation of the nerves.

In closing, one more suggestion is offered for thought, and that is as to the probable influence of the trophic nerve fibers. These are also sympathetic fibers, and convey impulses from the centers to the periphery. Their end organs lie in the tissues themselves, and they are called trophic because they govern the normal metabolism of the tissues to which they go. Many diseases are attributed to disease of these fibers or the centers from which they spring, such as the various forms of herpes, the condition known as glossy skin, progressive muscular atrophy, myxedema (seen in the nose as polypi), leukoderma, Addison's disease, anesthetic leprosy and bed sores. As every nerve is supplied with its own trophic fibers, it naturally follows that if these fibers become

diseased and lose their function that the nerve supplied by them will necessarily lose its function also. To the writer this offers a reasonable theory to explain why, in cases of long standing disease of the sinuses, the disturbances of vision do not always recover after the sinus disease has been cured, although in recent cases vision almost invariably does return. Irritation of any tissue for a short period of time will not produce any actual tissue change, whereas long continued irritation will cause actual destruction, and that is what probably takes place in these cases. At first, the sympathetic fibers lying on the sinus may be merely irritated, and thus produce the symptoms of increased vasomotor action, but after long irritation they become destroyed, and no longer govern the nutrition of the tissues. This would explain the loss of function of the optic nerve where no neuritis had been present. That all cases of sinus disease do not cause ocular change is readily understood in that no two sinuses are ever alike. The bony wall separating the sinuses from the cavernous sinus varies very greatly in thickness and also in density, and so the nerves are protected from harm in many cases.

SOME SERIOUS EYE CONDITIONS THE RESULT OF INTRANASAL AND NASAL ACCESSORY SINUS DISEASE

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In an address delivered before this Academy in September, 1906, on a similar topic, I said: "While the subject of the relation of the pathological condition of the nose and accessory sinuses to the visual apparatus was by no means unfamiliar, the last word pertaining to symptomatology and diagnosis has not been said and in the study of this region there is still much timber, tall and uncut; much anatomical and physiological work to do, and a still greater field for study in the pathological realm. Laurels and gratitude await the patient and persevering investigations of our members as to the etiology, diagnosis and treatment of diseases of the nasal accessory sinuses, and the serious ocular and visual disturbances that often result from their disturbed functions as the result of pathological conditions or mechanical obstructions." Prior to 1906 only one paper on this subject appeared in the Transactions of this Academy. Since then more than twenty papers with discussions have been read and published by our members.

Wonderful strides have been made, much good work has been done, much of the tall timber of ignorance and uncertainty has been cut, and, as the result of the closer relations of the oculist, rhinologist and internist, many hitherto unsolved problems of serious ocular conditions due to nasal conditions have been solved, and to many vision and comfort of body has been restored. The way has been well blazed, and to-day is being well paved for a greater work, for the last word has not been said as to symptomatology, etiology, diagnosis and treatment, and while many of our number have won "laurels and gratitude," there is yet much to be done, and the palm of victory that goes with success awaits the patient and persevering scientific oculist and rhinologist.

In our investigations, we must remember that in this day of specialism there is danger of our becoming cyclopic, and with this one eye only see the oto-rhinological part of the body, overlooking the possibility of danger that may result to the ocular apparatus

to which it is so intimately related. We still find that each case is a law unto itself, the symptoms often vary as much as do the size, shape and positions of the sinuses.

Experience and investigation of the etiology of many of the serious ocular conditions which we frequently meet with in our daily routine of clinical work brings increasing and unmistakable evidence of the truth that no one organ of the human body when diseased can be successfully treated to the exclusion of other organs and parts of that body. Often we find an intranasal condition, to all appearances presenting more than sufficient evidence for the cause of the serious intra-ocular trouble for which the patient consulted us, and we are disappointed and chagrined to find that when this is entirely removed the ocular condition is unimproved. On going deeper into other possible etiologic factors, we find a toxemia to be the cause of the ocular disease. This is more frequently of an auto-intoxication nature and due to faulty metabolism, beginning primarily in the gastro-intestinal tract; but it must not be forgotten, that we may have serious ocular conditions resulting from an auto-intoxication in which the alimentary canal has no part whatsoever. For this reason, if for no other, the oculist must needs have the assistance of not only the rhinologist but also of the internist, radiographer and laboratory expert.

In other words, the greatest accuracy and success can be gained only by the working together as one man, several specialists in the science of medicine. As yet we know of very few pathognomonic etiologic factors in the production of serious changes in the fundus oculi which result in either blindness or greatly impaired vision, and our diagnosis is often made by exclusion of other possible causes of the condition, and our treatment directed to attacking vigorously that which presents the greatest evidence of being the predominant etiologic factor.

This is not the time, place or occasion for me to consume valuable time by reports of individual cases illustrating some of the serious eye conditions which I have met with which were due to intranasal and nasal accessory sinus disease. A body of men such as is this, whose membership contains the majority of the leading oculists and rhinologists of America, does not expect in detail, minute clinical histories in the presentation of a topic for discussion at its annual meeting, hence I omit this and present briefly the lessons I have learned from my own individual work, and submit them for your consideration and discussion.

I have had five cases of neuroretinitis, nine of papillitis, three of "choked disk," one atrophy of the optic nerve and five of exophthalmus due to suppuration in the sphenoid sinus or posterior ethmoid cells; often both these were involved. In these cases the right eye was most frequently involved, and nearly all of them were complicated by a systemic condition, an autotoxemia, a low form of septicemia, neurasthenia or rheumatism. I refer in this report only to those in whom the diagnosis of the intranasal and accessory sinus condition was verified by subsequent operation. In twenty of the cases, the sphenoid sinus and posterior ethmoid cell walls were extremely thin and of large size; in the remaining four cases the very opposite condition was found. The best explanation of this, I think, is that given by Frank Brawley, who says: "Involvement of the eye is more likely to occur from infection in thin-walled sinus or where dehiscences occur in the bony walls, producing direct contact between the lining membrane of the sinus and the orbital periosteum, or even the sheath of the optic nerve. Adhesions may occur between the orbital periosteum or the optic nerve sheath and the bony sinus walls secondary to inflammation of the latter, and these adhesions may become vascularized, offering a direct route for infection of the ocular structures."

I have frequently observed in cases where there was a difference in power of accommodation in the two eyes, that this was relieved by getting rid of a middle turbinate which was hypertrophied, or from any cause producing pressure in the nose, either against the septum or antral wall. In those cases with a very narrow "nasal attic," if free ventilation and drainage through the infundibulum is interfered with, due to an obstructing middle turbinate, it should be removed, even though it presents no pathologic changes. Its long continued pressure in this region (the vicious circle) will eventually lead to pain, pus formation and ocular disturbance as the direct result of the negative pressure it causes within the accessory sinus. These points have been emphasized by Pynchon, Ballenger and myself in this Academy on other occasions, and need not be dwelt upon at length again.

In five cases of amblyopia in the right eye, where the vision varied from 20/180 to 20/200, which could not be improved by any lens, three of them had pansinusitis of the right side, but there were no intra-ocular or fundus changes except slight edema of the nerve head. In these the radical Killian operation was performed and all the accessory sinuses on the right side were

found to be filled with pus and soft granulations; the sphenoid sinus was very large, the walls thin and necrotic. Immediate relief of the local and systemic (septic) symptoms was the result of the operation, but there was no improvement in vision in either case for several months, when there was gradual and permanent (there has been no return for over three years) restoration of vision. These cases, as do all those I operate on for extensive intranasal and accessory sinus disease, were given small doses of iodin in daily increasing doses, and reconstructive tonics for from three to six months beginning the third or fourth day after the operation.

The other two cases presented no evidence of any pathologic condition either in the nose or accessory cavities, but the upper portion of the nose (the attic) was very narrow, and the small middle turbinate pressed tightly against the septum and antral wall, completely obstructing both ventilation and drainage through the infundibulum. Besides the loss of vision which was accidentally discovered in one case in the right eye by the patient, and in the other case by the oculist, both patients complained of nothing except a morning headache, which persisted from the time he got out of bed till about 10 o'clock, when it began to wear off. He could tell when relief was near because he always had an attack of sneezing a short time before. At the time of operating I had difficulty in cocainizing the parts with the finest cotton covered probe because of the extreme narrowness of the nasal attic, and even after the soft tissues were retracted by adrenalin the space between the turbinate and septum as well as the antral or outer wall of the nose was so narrow it was impossible to thoroughly apply sufficient of the local anesthetic to render the operation bearable.

In neither of these extreme cases and in many others of a similar nature in which I have removed the middle turbinate, did I find evidence of any pathologic change which had taken place in either the turbinate body or accessory sinuses. The pain was probably due to negative pressure caused by obstructed ventilation and drainage of the frontal and sphenoid sinuses, as well as the ethmoid cells; the amblyopia was due to toxemia, the result of congestion or venous stasis from the same cause. The relief of the morning headache was within a week following the removal of the middle turbinates, the restoration of vision within six weeks.

Attention is called to these five cases because they represent the extreme type and illustrate forcefully some of the very serious conditions of the visual apparatus resulting from intranasal dis-

ease and abnormalities. I have met with several cases of blepharospasm, dacryocystitis, pain in the eye with varying degrees of photophobia and epiphora, which were the result of nasal synechia following the use of the cautery or from hypertrophied or polypoid degenerated turbinates.

Within the past three years I have been especially impressed with how little intranasal surgery is necessary to relieve the most complicated and serious conditions in which the visual apparatus presents the most alarming symptoms, and I am finding fewer cases that require the radical external operation even for the relief of suppurative pan-sinusitis. In this respect the radiographer has been of inestimable help to us, in that he is able to demonstrate to us the abnormalities, peculiarities and ofttimes the pathological indications that each case may present, thus preventing our groping in the dark for the opening into the various nasal accessory sinuses. The pendulum has swung from the extremes of conservatism and radicalism, and these extremes are now uniting into what might appropriately be termed conservative radicalism.

The special field in which the rhinologist labors, when any surgical intervention is indicated in order to relieve pain, maintain health or to save life, differs from surgery in any other part of the body, in that ventilation is as necessary as drainage. The highest aim of the rhinologist should be to save as much of the active functioning nasal mucosa as possible and not destroy it. I have contended for years, and now repeat the contention with emphasis, that the "offshoot" of the ethmoid bone, known as the middle turbinate, is more frequently at fault in the production of intranasal and nasal accessory sinus diseases than all other causes combined, because of its proximity to the infundibulum and the so-called vicious circle of the nose. When it is enlarged or adherent, it blocks both ventilation and drainage of all the sinuses and its thorough removal with a minimum amount of traumatism and after-treatment in the form of vapors, sprays, douches, ointment and powders, is productive of more good than all other intranasal operations or treatment.

In conclusion, no two specialties or specialists ought to be more intimately related than the oculist and rhinologist, and these two, far more frequently than is at present admitted, need the cooperation of the internist, radiographer and laboratory expert.

The work of Brawley, Ziegler, Pynchon, Ballenger and DeSchweinitz in the American rhinological and ophthalmological field, who have gone so minutely and accurately into the investigation and elucidation of this subject, deserve not only special mention but the thanks of this Academy.

PHYSIOLOGIC AND PATHOLOGIC RELATIONS OF THE EYE AND ACCESSORY SINUSES OF THE NOSE

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After selecting this subject, which has been of considerable interest to me recently, I began looking up the literature to ascertain what other men had said on the subject, in order that I might make comparisons. I soon was brought to a realization of the fact that what I could possibly say has already been said by a number of very eminent men, so that I fear what I may present on this subject will be more or less a repetition of what has already been said, the effect of which will carry much more weight than anything which I might offer. However, after giving a brief anatomical description of the relationship, both of the osseous and nervous anatomy of the eye to the accessory sinus of the nose, I shall attempt to describe a few interesting cases which I have had in my practice during the last year.

In order that we may have a comprehensive idea of the relationship existing between the eye and the accessory sinuses of the nose, it is necessary to have a fair anatomical knowledge not only of the osseous parts, but of the sensory nerve distribution as well. Without this, an intelligent appreciation of the nervous and pathologic reflex symptoms would be difficult of interpretation.

With the greater portion of the floor of the orbital cavity in close proximity to the maxillary sinuses, the internal lateral wall to the ethmoidal and sphenoidal sinus and the superior plate anteriorly to the frontal sinus, we can readily appreciate the close anatomical relationship existing between these parts. While as a rule a thin, bony wall separates the sinuses from the orbit, it is not infrequent to find dehiscences of the bone which leave only mucous membrane dividing them.

The nervous anatomy can best be understood by briefly tracing the sensory branches of the fifth nerve from the Gasserian ganglion to the termination of its branches; beginning with the Gasserian, which lies in a depression at the inner end of the petrous bone, the nerve divides into three branches, the ophthalmic, the superior maxillary and the inferior maxillary; the two upper

branches being entirely sensory, while the lower trunk unites with the motor root supplying muscles of mastication.

From the ophthalmic division there is given off a meningeal branch to the tentorium cerebelli, and supplies nerves of sensation to the eyeball, conjunctiva, lachrymal gland, nasal fossa and skin of the nose, eyebrows and forehead. It receives branches of communication from the cavernous plexus of the sympathetic and from the third, sixth and occasionally the fourth.

The lenticular ganglion situated in the orbit receives a branch from the nasal nerve, and sends nerves to ciliary muscle and iris. The superior maxillary division gives off a meningeal branch and supplies nerves of sensation to the upper teeth, lip, cheek, temple and the lachrymal apparatus.

The sphenopalatine ganglion, which lies in the sphenomaxillary fossa, receives a branch from these nerves, one from the carotid plexus (the vidian), a branch from the facial, and sends nerves to the pharynx, palate, turbinate bones and floor of the nose.

The association of the nasal and orbital nerve supply is even closer than that of the circulatory system. The nasal nerve, which is a branch of the ophthalmic division of the fifth, passes through the orbit to the anterior ethmoidal foramen, then back to the cranial cavity in the region of the cribriform plate of the ethmoid, which it pierces to enter the nasal cavity to supply its anterior half. Its orbital branches are the two long ciliary nerves, the intratrochlear and a branch to the lenticular ganglion.

The ophthalmic artery, which sends branches to all of the orbital structures, sends off anterior and posterior ethmoidal branches and the nasal artery. Returning from the nose, the ethmoidal veins enter the superior ophthalmic vein, and as the orbital veins have no valves, blood may pass in either direction. The venous plexuses of the turbinate bodies empty into the pterygoid plexus, and are in direct communication with the orbit by way of a branch to the inferior ophthalmic vein. Thus it is easy for organisms or their toxic products originating in the nasal accessory sinuses to reach the interior of the eye through the ciliary vessels, which are branches of the above mentioned arteries and veins.

The chronic forms of sinuitis present a large number of eye symptoms, with comparatively no manifestations of nasal trouble. In the suppurative form of sinuitis the middle turbinated body will be found in a state of hypertrophy, and the ethmoidal cells will break down under slight pressure; the discharge will be

thick and tenacious, with usually more or less odor, depending on the extent of retention of pus and necrosis.

In the chronic non-suppurative form of sinuitis the ocular manifestations will be more obscure and uncertain than in the suppurative variety. In this form, the middle turbinate is somewhat enlarged, probably showing some polypoid degeneration on its under surface. If the middle turbinate lies close to the external wall, the polypoid degeneration may not be manifest in the early stages, but later will appear at the lower margin of the anterior end of the turbinate. The ethmoidal cells are generally filled with polypi, with frequent destruction of the intervening partitions due to pressure. Along with this condition, oftentimes, on account of the intrasinus pressure, ocular structures may be affected through dehiscences in the bony partition, resulting in pressure on the extra-ocular muscles, causing a train of symptoms tending to eye-strain and more or less nervous phenomena. Both of these forms obstruct more or less the circulation, and account for symptoms caused by the vascular changes.

The orbital manifestations of chronic hyperplastic ethmoiditis are of special interest, not only on account of the obscure picture which they often present, but also on account of the frequency with which they appear. These are usually of a mechanical origin, due either to the intracellular pressure from the hypertrophied mucous membrane or to stasis in the hematogenous or lymph channels, or both. These may interfere with the mobility of the globe, irritate the optic nerve through pressure, produce changes in refraction or disturbance of physiological lachrymation.

The subjective symptoms consist of scotoma, neuralgia, pain in the eye, ciliary neuralgia and photophobia. In severe cases vasomotor disturbances, such as hyperemia of conjunctiva and edema of eyelids and peri-orbital tissues may occur. The appearance of these reflex neuroses is but to be expected when one recalls that the orbital and nasal cavities are supplied by the same sensory nerve.

In selecting the following cases which I wish to report I shall present those which gave definite ocular symptoms without any evidence of previous sinus involvement, as has been demonstrated by the promptness with which ocular symptoms disappeared when the sinus trouble was corrected.

Case 1.—Miss A., aged 35, for about two years had headaches, deep-seated between the eyes, and at times ocular pains. The symptoms were aggravated by use of eyes for near work, especially during the menstrual period, and growing progressively worse.

On examination, vision of both eyes was practically normal. Fundus examination showed considerable congestion of the optic disk, otherwise a normal fundus. On examining the nose, a badly deflected septum, very much thickened at the posterior end, was found, with considerable hypertrophy of the right middle turbinate.

An operation was advised for correction of the trouble, which was accepted. The hypertrophied portion of the middle turbinate was removed, and a submucous resection of the septum done. On removing the deflected portion of the vertical plate of the ethmoid bone, on approaching near its posterior border, a large, healthy pneumatic cell was encountered with apparently no opening leading from it. While cutting away the edges of the cell with the bone biting forceps, another cavity was broken into which proved to be the sphenoidal sinus filled almost completely with granulation tissue. After making the opening as large as possible into this cell, two large masses of granulation tissue were removed, which proved to be a complete cast of the sinus. As there was no opportunity for after-treatment through this channel, a search was made for the natural opening in the right nostril, and was found to be quite small. A generous opening was made down to the floor of the sinus and each nostril packed to co-apt the layers of the septum.

After the septal wound had healed and the sinus treated for two weeks, the headaches and ocular pains disappeared, and so far there has been no return of the trouble.

Case 2.—Miss B., aged 25, stenographer; for nine months had been suffering from repeated attacks of deep-seated headaches, far back between the eyes, with considerable mental depression. Vision of right eye 20/20; left eye 20/40. Fundus was negative. No history of nasal trouble, but as the eye symptoms gave no definite clue to the cause, an examination of the nasal cavity was made, disclosing a very much enlarged posterior end of the left middle turbinate.

After snaring off about one-third of the posterior end, I was able to locate the opening of the sphenoidal sinus. A cannula was then passed into the sinus and a considerable quantity of foul-smelling, dark green pus was syphoned out, after which, on searching the sinus with a probe, I discovered what appeared to be a dehiscence in the bone in the left wall near the roof. After enlarging the opening, the patient was placed in a recumbent position and the sinus was filled with a 12 per cent. phenol-glycerin, which was allowed to remain for twenty minutes. This was repeated every day for about two weeks, at the end of which time the headaches and mental depression had both disappeared, with vision in both eyes 20/20.

Case 3.—Mr. C., aged 32, farmer, complained of pain in the eyes, photophobia and more or less dimness of vision for the last five months. Vision of right eye 20/20, left eye 20/40; pronounced displacement of left eye outward, with marked diplopia,

one image being more distinct than the other. There was no special tenderness or discoloration of the eye; fundus examination showed congestion of the disk and retina.

Nasal examination disclosed an enlarged middle turbinate on the right side with polypus showing under it. On removing the anterior, a small polypus came away, and what appeared to be a pedical of another growth which had been cut off by the snare, was projecting into the opening. This was grasped by forceps and after considerable manipulation and traction was removed, and proved to be a polypoid growth, 1¼ inches long and ⅜ inch broad. The direction from which it came disclosed the fact that the bulla ethmoidalis had been destroyed, and a dehiscence in the orbital wall permitting the growth to pass from the ethmoid cell to the orbital cavity, and back part way around the globe. This opening was packed lightly with antiseptic dressing, and in ten days' time had entirely closed. Two weeks later the globe had receded to its normal position, vision became 20/20 in both eyes and binocular single vision was again restored.

Case 4.—Mr. D., aged 35, bookkeeper, for some six months complained of headaches and inability to use his eyes for close work without great aggravation of symptoms, with at times intra-ocular pains which radiated to occiput. Vision in both eyes was 20/30 with some blurring; hyperemia of the disk with some congestion in the retina, both eyes being much the same.

Nasal examination showed enlargement of middle turbinate on both sides, pressing both on the septum and the lateral wall. Some pledgets of cotton, previously saturated with adrenalin, were placed in each nostril and allowed to remain about ten minutes. After their removal, he expressed a feeling of greater comfort in his eyes than he had experienced in a long time. A partial removal of each middle turbinate was done, and after healing had taken place the ocular symptoms entirely disappeared. In two weeks' time both eyes were 20/20 and remained so.

Case 5.—Mr. E., aged 40, for the last two years had complained of headache and photophobia, with more or less vertigo upon using the eyes for close work. Vision 20/20 in right eye, 20/40 in left eye; retina pale and vessels but partly filled.

On examining the nose, the septum was found deflected to right side, pressing on the posterior half of the middle turbinate bone. This was corrected by a submucous resection of the septum, after which the osteum of the sphenoid sinus was located. It was unusually small. On passing a cannula into the sinus the mucous membrane was found to be very much thickened and spongy, showing a chronic non-suppurative condition. The opening was enlarged down to the floor of the sinus, the patient was placed in a recumbent position, and the sinus filled with a 10 per cent. phenol-glycerin, which was allowed to remain fifteen minutes. This treatment was repeated every other day for ten days, at the end of which time the symptoms complained of had all dis-

appeared. Vision was 20/20 in both eyes, and he was able to do close work with comfort.

The immediate and pronounced favorable results obtained from surgical treatment of these accessory cavities should be further proof of the relationship existing between the nose and the eyes. The opinions of various investigators differ somewhat as to which sinuses are most frequently involved in producing these obscure symptoms. I think the concensus of opinion, however, is that the ethmoidal, sphenoidal and maxillary sinuses in the order named are most frequently involved. I am in hearty accord with Brawley, who says: "When one considers the very intimate relationship between the orbital contents and the nasal accessory sinuses by way of the nerves, blood-vessels and lymphatics, it is remarkable that sinus empyema does not oftener cause serious ocular disease."

When we consider that the orbit is from one-half to two-thirds surrounded by bony cavities, which are in direct communication with the nose, it is not hard to realize that pathological changes of these cavities may profoundly affect the ocular structures. The thickness of the bony wall between the orbit and sinuses varies considerably and in the majority of cases is quite thin, varying from ¼ to 2 mm. in thickness, and at times is found to contain dehiscences of variable size, which admits of one cavity being readily affected by pathologic conditions of the other. These influences are probably the most marked where the optic chiasm and nerve are in such close proximity to the sphenoidal sinus.

The liability of the optic nerve to become affected in sphenoidal sinus involvement is due in part to the fact that the nerve is not in a strict sense a nerve at all, but a central intercerebral cord (Spalteholz) having coverings similar to the brain and spinal cord. The fact that it has a higher specialized function makes it more easily affected by pathological changes around it, while at the same time the absence of sensation makes disease in this tract insidious.

As we go into the minutiae of the parts involved and study more carefully their relationship, and by careful observation of clinical cases, aided by transillumination and skiagraphic pictures, thus become more able to appreciate what many of the hitherto ill-defined and obscure symptoms mean, we must conclude that we have long been groping in the dark as to the cause for many of the abnormal ocular manifestations, hence a closer study and a more careful watch of our cases of this nature cannot fail of a satisfactory explanation for many of them.

THE SURGICAL ANATOMY, DIAGNOSIS AND TREATMENT OF THE INFLAMMATORY AFFECTIONS OF THE NASAL ACCESSORY SINUSES IN CHILDREN

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Inflammatory affections of the nasal sinuses occur more frequently in children than is generally considered. Not only does this statement apply to the adolescent, but also to the small child and infant. From a study of the surgical anatomy of the nasal accessory sinuses, it does not seem improbable that some instances of meningitis are the result of unrecognized sinusitis. This can readily be appreciated from the structure of these parts, as there is great variation in their size and shape; they are surrounded by much softer bone than occurs later in life, there is greater development of the vascular and lymphatic systems, and the mucosa is in intimate relation with the osseous tissue, so that inflammation of the former produces some pathologic changes in the latter.

My experience has been that chronic sinusitis is not as frequent as in the adult, but both acute and subacute sinusitis are common, and it will be found that many instances of postnasal catarrh are but symptoms of some inflammatory condition of the adjacent sinuses.

CASE 1.—C. M., a boy aged 12, following measles three years previously, had a constant discharge of mucous from the postpharyngeal region. Two years later I first saw him, and found his pharynx and nasopharynx in good condition, and that the discharge of which he complained came from the posterior nasal cavities on both sides. The turbinals were but slightly congested and swollen, but after careful repeated observations it was found that the trouble was confined to the posterior group of ethmoid cells on both sides. After free drainage was obtained through surgical intervention no further trouble was experienced, the discharge ceasing entirely.

In connection with the anatomic development, it should be remembered that the maxillary sinus is well defined, although rudimentary at birth, and even in the fetus it is found about the fourth month, so that inflammation of this sinus at an early age is not infrequent. From this early form which represents the adult sinus, but in miniature proportions, and which has a triangu-

lar shape, it undergoes but little change until the second dentition, when the development of the molars and bicuspid teeth play an important part in its relation to the bones of the face. In the new-born, it is situated internally to the orbit and does not sink below it until some time later, while its mucous membrane lining, which is tenuous in the adult, is exceedingly thick, so that it almost fills the small cavity, leaving but little space in which pathologic fluids might accumulate.

Previous to the completion of the first dentition, the odontoblasts are in most intimate relation with the floor of the sinus, which is usually high, reaching about to the attachment of the inferior turbinal body. The floor of the antrum in the child previous to the second dentition is on a line with the nasal floor, and it is not until a later age that it becomes lower as in the adult type, reaching the latter type at about the twelfth year. The increase in size of the antral cavity occurs principally at the expense of the alveolar process, which is in part absorbed with the resultant downward enlargement of the cavity, when the thickest wall is then found to be formed by the body of the superior maxilla posteriorly, while the orbital wall superiorly is of extreme tenuity.

Of all the walls of the antrum the nasal aspect is the most important, not only surgically, but also from a diagnostic standpoint, on account of its tenuity and from the fact that at this point visible pathologic changes are found in immediate conjunction with the natural stomata. Much previous to this, however, accessory foramina are found, but not as frequently as in the adult, and the stomata opens into the middle meatus at the posterior end of the semilunar hiatus.

Most important in the child are the inflammatory affections of the ethmoid cells, these cells and the antra being more frequently involved than the frontal and sphenoidal. Evidences of the ethmoidal area are seen in the fetus about the fifth month, and distinct cells are frequently found at birth, often eight to ten being found during the first year, and from that period on these tissues are susceptible to morbid changes, the cells reaching their maximum development about the eighteenth year. Frequently these cells are rudimentary, however, and occasionally one finds a misplaced cell that makes it rather difficult to locate the various parts with any degree of accuracy. In the child as in the adult, the middle turbinate body is essentially a portion of the ethmoid area, although its anterior end is thinned out, is small, and runs parallel to the perpendicular plate, so that the lower border is deflected inwards.

At about the eighth to the tenth year, one finds that the ethmoidal ostia open into the nasal meati, and for surgical purposes, especially in the recognition of morbid changes, the cells can be grouped into an anterior mass communicating with the middle meatus, while the posterior group opens into the superior meatus. The anterior group is by far the most important, as its stomata are found along the semilunar hiatus and the fissure between the ethmoidal bulla and the inferior turbinate body, at a location where infection from intranasal morbid changes most frequently take place. The anterior cells are more numerous than the posterior, although the latter are larger as regards the capacity of the individual cells, but their stomata are much less in size than those of the anterior mass.

As the internal wall of the orbital fossa forms the external boundary of the ethmoid, the possibility of orbital symptoms as a complication of ethmoidal infection is apparent. In operating in this region, this relationship must be borne in mind on account of the extreme thinness of the orbital wall, and the danger of injuring the contents of the orbital cavity.

Case 2.—C. D., aged 1 year. Measles; profuse mucopurulent discharge from both nostrils during the course of the disease. After convalescence continuation of discharge from left nostril. When seen, considerable unilateral orbital cellulitis and swelling of cheek, proptosis, conjunctival ecchymoses and ectropion, discharging sinus at lower angle of orbit. Probe passed into sinus entered area of roughened bone in ethmoidal region. Puncture of maxillary antrum through nasal wall with positive results. Incision of orbital sinus and incision over and removal of portion of nasal process of superior maxilla to expose ethmoidal tract, which was then removed with cutting forceps. Convalescence uneventful.

Previous to the seventh or eighth year the frontal sinus is usually not developed to any extent, although from the second to the third year it is not uncommonly found as a mere trace of a cavity. Rather infrequently it is present as early as the fifth year as a definite cavity subject to pathologic changes, but before puberty it does not extend far up in the frontal bone, but then a marked change takes place, continuing until the eighteenth year, when its full development is accomplished. It must always be borne in mind that the frontal sinus is a sequence of the cellular expansion of the anterior group of ethmoid cells into the diploë of the squamous portion of the frontal bone, and that in the treatment of inflammatory conditions here the intimate relationship with the ethmoid region must always receive due considera-

tion. The anatomical and surgical relations differ in no way from that in the adult, excepting that its relation to the cranial cavity on account of the thin posterior wall is most intimate, and this must be considered in relation to inflammatory processes.

The sphenoidal sinus may show as a depression in the cancellated tissue of the sphenoid body even at birth, and a definite cavity may be present at the fifth month, although of necessity it is a mere slit in the soft osseous structures, a definite cavity being found as early as the third year, while by the twelfth year it is well developed, and while its inflammatory changes have not been as much studied as have the other sinuses, yet I am of the opinion that it is more frequently involved than usually considered. Strangely, however, it seems that the capacity and size of the sphenoid cavity is most erratic, and the age of the child gives but little information as to these factors. A study of several anatomical specimens will usually show marked variations so that a young child may have a comparatively large cavity, and a much older child will have a very small one. Its lateral walls are largely within the intracranial cavity, and especially is this to be considered in relation to the development of obscure cases of basal meningitis, as is also its intimate relations laterally and superiorly with the internal carotid artery and cavernous sinus.

Case 3.—M. S., aged 3. History of unusually frequent coryzas. Nasal diphtheria followed four weeks later by temperature, neck rigidity, double Kernig and convulsions.

Examination.—Excoriated upper lips. Slight anterior nasal discharge. Much mucopus in nasopharynx. Child semicomatose and moribund. Death. Post-mortem inspection of nasal chambers. Middle turbinates and septum removed to expose the sphenoid. Anterior wall of sphenoid removed and cavity found to contain large quantity of pus. Culture, streptococcus pyogenese. No cranial post mortem allowed, but it seems likely that the meningitis was directly the result of the nasal accessory cavity infection.

The recognition of sinusitis in the child is more difficult than in the adult, as the symptoms are usually obscure, are rarely characteristic, and it is rather unusual to have a single sinus involved to the exclusion of the others, the rule being that more than one sinus is affected at the same time. Under such circumstances, one can well appreciate the difficulty of differentiating individual inflammatory areas. When the superior sinuses are the seat of a purulent inflammation the discharges may infect those lower down, especially the maxillary antra, so that the soft tissues around the stomata are kept irritated and swollen, and

it becomes most difficult to determine the exact primary condition.

The frequency of the infectious diseases in childhood and the concomitant inflammatory changes of the nasal mucosa, explains why the sinuses should be involved during this period, and especially does this occur in influenza, scarlet fever, measles, pneumonia and diphtheria. In the vast majority of cases there is a primary inflammation of the nasal mucosa, and the sinuses become involved from direct extension of this inflammation, irrespective of its basal cause, the swelling of the soft tissues around the sinus opening causing the secretions to be retained as a result of the stenosis thus produced. Unlike that which may occasionally occur in the adult, sinusitis in the child is practically never of primary origin, as the close relationship of these tissues with the nasal mucosa is such that when the latter is inflamed from any cause the former must invariably be simultaneously involved.

In the new-born, antral sinusitis may occur as a result of infection by vaginal discharges from the mother or from injury, the result of instrumental delivery, and the resultant purulent inflammation involves the soft osseous antral walls. In my experience, this condition arising from these causes or others in small children is a true sinusitis as definite as that found in the adult, and it is not a tuberculous caries or osteomyelitis, as has sometimes been claimed. As a rule, affections of the antrum occur during the second dentition, while infrequently errors in the development of the teeth may act as an exciting cause of the empyema. In such cases the relation of the teeth to the maxillary cavity must be carefully considered, and the radiograph alone will clearly elucidate the conditions along the alveolar process.

The ethmoid labyrinth in the older child is especially liable to become involved in all inflammatory affections of the nasal mucosa and in coryza. In the contagious diseases these cells are affected in practically every instance, to my mind accounting frequently for the manifest suppurative ethmoiditis in later life, which has in reality existed from early childhood.

The recognition of the various sinus affections in the child is more difficult than in the adult, as the subjective symptoms are not clearly defined. Great weight should be attached to the intranasal findings.

Transillumination in my hands as a method of diagnosis has proven of great value, providing it is used in connection with a regulating rheostat to measure the intensity of the illumination. I have found of considerable use, when its introduction was pos-

sible, the electrically illuminated pharyngoscope, as one can explore readily the nasal areas, and the recognition of posterior ethmoid and sphenoid disease is much facilitated. The use of carefully made Roentgen plates is of great service, especially as regards the presence of pus in the antra, or frontal sinuses, and previous to the tenth year the use of the stereoscopic radiograph is the most valuable single diagnostic medium that we possess. A markedly swollen mucous membrane, however, will give a shadow more clearly than the presence of pus in a sinus.

The presence of frequent headache should always occasion suspicion of sinus inflammation, as should also tenderness to touch over the suspected sinus, such a symptom, however, being of practical value mostly as regards the frontal sinuses, bearing in mind that localized pain is difficult to ascertain with accuracy in the very young. When headache is present, however, it is most important as a part of the general complex of symptoms, but its absence indicates nothing, and as a symptom alone without other intranasal signs it is of no value from a diagnostic standpoint. In acute sinusitis, pain of an aching character, or acute, neuralgic in type, even like that of the adult, is almost invariably present at some time during the course of the inflammation, but in chronic cases it is frequently absent, unless the secretions are retained under pressure, when it may become most intense, remembering in this connection that the degree of pain in the head very often bears no relation to the severity of the inflammatory process of the particular sinus involved. A dull pain between the eyes, however, in the presence of other intranasal symptoms, is strongly indicative of ethmoid involvement.

A marked symptom of great diagnostic value when present is the cessation of pain with the appearance of free nasal discharge, and the return of the pain when the discharge lessens or temporarily ceases. The presence of discharge, especially if unilateral and purulent or semipurulent in character, is always of diagnostic value, particularly if intermittent. But, the presence of pus in the nasal chambers is in small children not necessarily indicative of sinus disease, yet at the same time it is important to remember that the absence of pus does not necessarily mean the absence of a purulent sinusitis. Curiously, in purulent sinusitis in children the nasal chamber may be entirely free from pus during irregular periods of the day, so care must be taken in considering this, as serious errors may ensue. If there is lymphoid tissue in the vault of the pharynx, most marked on the side from which this

discharge comes, it will often be found that the adenoids alone are not the source of the continued coryza from which the child suffers, but in addition there is a sinusitis.

The location of the discharge is of great value in determining which sinus is affected, and the method of ascertaining this differs in no way from that in the adult, which is so well known as to require no further discussion here. At the same time it is important to bear in mind that the pus may be inspissated, or of such a thick character that it will not drain freely, so that during certain periods of the day it is apparently absent. On the other hand, if purulent fluid should be present in the nasal chamber it is a positive indication that a particular sinus is involved; also, if the fluid rapidly continues to reappear in the same location as soon as it has been removed. Such a symptom is indicative of the fact that a collection of pus of some standing is present, as it cannot be secreted in this manner from the mucous surface.

Aprosexia and disturbance in the general health are more or less inevitable concomitants of chronic purulent sinusitis. Not infrequently it will be found that there is a daily rise of temperature of a degree or more, while in addition the pulse will be more rapid than normal. Complications are possibly not as frequent as in the adult, although orbital symptoms are not uncommon. In the so-called strumous child, where there is a purulent nasal discharge with excoriated upper lip and marginal blepharitis, frequently with corneal ulcers, purulent sinusitis of the antrum and ethmoid cells usually exists, and while serious organic osseous changes are not present, yet when they do occur the ethmoid structures are the ones most frequently involved. The formation of polypoidal degeneration seen in the adult is most infrequent, and usually when it does occur, in my experience, is strongly indicative of a latent specific basis. In purulent inflammation of these sinuses, and especially in that acute fulminating type sometimes seen, serious orbital complications may ensue as a result of pathologic changes in the correlated vascular sinuses, with the development of cavernous sinus thrombosis, resulting in pyemia, meningitis and death. In the milder form, a symptom not uncommon and always of diagnostic value is edema of the eyelids from vascular pressure.

In inflammatory processes affecting the maxillary antrum, it is not uncommon to find some involvement of the osseous structures of the superior maxilla if the purulent sinusitis is long continued. In children under 1 year of age, a true maxillary

empyema may occur with the development of abscess and fistulae in the infra-orbital region, but in the majority of instances the affection presents rather a benign course, and is only too frequently unrecognized, and only treated as "nasal catarrh." After cleansing the nasal chamber, the reappearance of pus in the middle meatus is indicative of antral suppuration, appearing most often beneath the middle turbinate. In older children puncture of the lateral nasal wall of the antrum is necessary to establish the diagnosis of the condition. In very small children this procedure must be performed most cautiously.

As a result of neglected rhinitis, inflammatory changes in the ethmoid structures are frequently found, but it has been my experience that an isolated sinusitis is uncommon. In younger children, the antrum is apt to be simultaneously involved, while in older ones the frontal sinus may be also affected, and not infrequently it will be impossible to differentiate between a frontal sinusitis and an ethmoid affection, in which the anterior cells of the latter are involved—but for practical purposes this is of little moment. On account of the relation of the complicated ethmoid system to the other sinuses, and the fact that pathologic changes occur here so frequently as a result of the various infectious diseases, it will be found that this sinus is the primary source of infection in the great majority of cases of pansinusitis. This relationship is especially to be emphasized on account of the intimate connection of the various stomata of its component cells with the other sinuses, as a purulent discharge here is almost impossible without more or less involving other sinuses. The difficulty of diagnosis in such cases is also enhanced by the variations in the location of the stomata of the sinuses involved; as the variations in their location are so frequent, that in the soft tissues of the child, the accurate recognition of the particular sinus involved, in a given case, may present the gravest difficulties. Anatomically this becomes evident when one recalls that the ethmoid mass occupies at least one-half of the space between the cribriform and the nasal floor, and therefore its various cells, each with its own stomata, are peculiarly subjected to the brunt of any inflammatory changes which may take place.

As a result of the late development of the frontal sinus, as has been previously pointed out, chronic changes are unusual, but its involvement in the older child during acute intranasal inflammation is much more frequent than actually considered.

CASE 4.—M. T., female, aged 12, had a severe attack of coryza five months ago, which her physician stated cleared up in about ten days, with the exception of a periodical headache over the right supra-orbital region, and a semipurulent discharge from the nares of the same side. Two weeks later she complained of a dull ache constantly present over the right frontal sinus, which became most acute about 10 o'clock each morning and lasted for about two hours, when the extreme pain would subside coincident with a free discharge of purulent fluid from that side. There was considerable tenderness to pressure over the sinus, and examination showed the left nares normal, while on the right side there was marked turbinal engorgement and purulent discharge coming from the middle meatus. The radiograph showed a shadow on this side, while all the other sinuses were apparently normal. The use of warm saline irrigations were without effect, and as the symptoms were not relieved after several days of this treatment the anterior end of the middle turbinal was resected, which gave free access to the sinus, and irrigations, followed by the injection of a weak argyrol solution, were followed by the prompt disappearance of both headache and purulent discharge.

The recognition of inflammatory changes in this region does not differ from that in the adult, and the presence of pus in the middle nasal meatus may greatly aid in establishing the diagnosis, although it may be easier to eliminate suppuration of the frontal sinus than to define its presence. The value of a well-made radiogram in defining the surgical aspects of the frontal sinus, as to its presence or absence, height, depth, etc., is of the utmost importance. The pain is apt to be more localized over the affected sinus than that which occurs in other regions, and while it is often dull in character, it is at times violent or throbbing, and is accompanied with local tenderness.

The recognition of purulent sphenoidal sinusitis is by far the most difficult. It is practically always combined with ethmoidal changes, and the symptoms are not characteristic. Severe occipital or vertical headache, with more or less dizziness, is suggestive of retained secretions; the discharges are scant and usually become inspissated in the nasopharynx, or along the posterior portion of the vomer and floor of the nasal chambers. It will be found that not infrequently the condition cannot be recognized until exploration has been made of the interior of the sinus.

The routine use of the pharyngoscope in young children has disclosed a surprisingly large number of cases of posterior ethmoidal and sphenoidal suppuration, which would have been unrecognized by any other method of examination.

Most important is the fact that these inflammatory invasions signify a radical disturbance of the entire drainage system of the nasal interior, and all treatment, whether conservative or radical, must rest on this basis.

The treatment of sinusitis in the child should always aim to destroy as little tissue as is consistent with obtaining permanent results, and as far as possible the nasal mucosa should be preserved, if operative measures are employed. Palliative treatment will permanently cure the majority of acute sinus inflammations, where such treatment is intelligently directed toward free drainage and the reduction of inflammation. Previous to the employment of surgical measures, therefore, the use of warm alkaline sprays, or normal salt solution and a weak epinephrin solution to reduce the congested mucosa, with, if the case is severe, rest in bed, the employment of laxatives and such general measures as may be indicated, will often produce the most happy results. In this connection it should be remembered that the tendency of acute sinusitis is toward a cure. The local employment of cocain in these acute cases is usually unnecessary, and is to be deprecated. Much relief may, however, be obtained by the external local application of heat, cold, or the use of the steam atomizer.

Where the sinus disease has continued and resisted treatment, it may be found that the general health of the child has been impaired previous to the development of the nasal affection, as a result of the original disease causing it, and until proper care of the general health is instituted, local measures may not be of much avail. It would be well under such circumstances to obtain a culture of the micro-organisms present in the sinus, and to have prepared an autogenous vaccine which may increase the opsonic index and powers of recuperation. Intranasal treatment, I believe to be primarily indicated in all cases of sinusitis in children, but it should be strongly emphasized that the turbinal tissue should as far as possible be preserved, and while it is necessary at times to remove the anterior end of the middle turbinate body, yet the removal of its entire structure to reach the stomata of any of the sinuses is not warranted.

As an example of intranasal treatment in such conditions:

Case 5.—M. L., female, aged 6. Unusually well-developed and healthy child. Had an attack of influenza of unusual severity six months before coming under my observation. This was accompanied with profuse purulent discharge from both nares, which completely ceased on the left side within a few weeks, but has continued on the right ever since. When she came to my office

the left nasal cavity was normal, as was also the pharynx, but the right cheek was tender to pressure and she complained of more or less constant dull pain over the infra-orbital region. The right nasal chamber contained pus which, when removed, reappeared in the middle meatus. As it was impossible to enter the sinus through the natural opening, a puncture was made in the thin lateral nasomaxillary wall. A metal cannula was left *in situ* through which irrigation was practiced every day for two weeks, then at less frequent intervals, until at the end of five weeks no trace of discharge could be found, when the cannula was removed. No evidence of any nasal suppuration has manifested itself since —being now two years.

When possible, drainage should be obtained through the natural openings, and to accomplish this it is proper to remove enough tissue at such points as may be required. It should be remembered in this connection that the greatest caution must be exercised in any operative procedures involving the superior portion of the nasal chambers, as in the child the anterior segment of the cribriform plate is especially thin where the branches of the olfactory nerve penetrate, and is particularly susceptible to injury with possible serious results.

When the frontal sinus is involved, its relation to the anterior group of ethmoid cells is such that attention must be paid to them before the inflammation of the mucous lining the frontal sinus will subside. When the antrum is diseased, inflammatory changes as a rule readily subside under ordinary treatment; but in obstinate cases, after fracturing and pushing aside the inferior turbinate body, a large opening should be made through the inferior meatus into the sinus and the parts drained in this way, the use of irrigation depending on the character and chronicity of the purulent discharge. Aspiration and subsequent lavage are indicated in older children instead of more radical measures, when the antrum continues to discharge pus and does not respond to the usual treatment.

The following case illustrates the conditions that prevail when the ethmoid area is involved:

Case 6.—C. L., male, aged 12. Had a severe rhinitis which resisted treatment for six weeks, when I first saw him. He complained of dull headache all over the head, a purulent discharge from both nares, and inability to breathe through the nose. Both middle turbinals were swollen and occluded the meatus and considerable pus came from the ethmoid region. Under shrinking with adrenalin, followed by warm saline irrigations, the purulent discharge completely ceased on the right side, but it was necessary to open the anterior group of ethmoid cells on the left side before

the pain in the head disappeared, and the purulent discharge entirely ceased.

In some fulminating forms of sinusitis in the child, and in the persistent suppurative cases resisting endonasal treatment, with impairment of the general health, or violently acute symptoms, external operation will be indicated. However, previous to any radical external operation in the child, a careful examination should be made for any morbid changes in adjacent areas which may be keeping up the sinusitis by interfering with drainage. It has been my experience that in not a few instances treatment for a considerable time may be of benefit until a hypertrophy of the middle turbinate body has been removed, or possibly an adenoid mass in the nasopharynx, which has acted as a constant source of reinfection. It should be emphasized that the enlargement of the middle turbinate body is a serious obstacle to the cure of inflammatory changes in any sinus and until this has been relieved the sinusitis may prove most obstinate to treatment. The attempted removal of purulent material in the child by suction or negative pressure has not in my hands been of much value, and I am not certain but that it has exercised a harmful effect.

Free drainage must be secured before cure can be obtained, and if intranasal treatment fails to obtain such a result, then whatever radical operation may be selected should be performed. It should be also emphasized in this connection that free drainage means free nasal respiration, and this is another prominent factor which must be taken into consideration in the surgical treatment of these conditions. In addition, it is essential that whenever pus is found in any of the sinuses it must be evacuated as a surgical principle. On this basis rests the surgical treatment of all chronic sinus affections, with the various modifications of technic in the care of individual sinuses dependent on the peculiar anatomic structural characteristic of each.

When the external radical operation on the frontal sinus is under consideration, it is essential, therefore, as a preliminary step to remove the anterior portion of the middle turbinate body in order to secure thorough drainage. The external operation on the frontal sinus in the young should be performed with the greatest reluctance in the absence of external or intracranial symptoms. When it is necessary to operate on this sinus it is well to attempt an osteoplastic procedure and to form an anterior bony flap.

In those cases where the frontal sinusitis has been unrecognized, a fistula may have resulted, and the condition has possibly been treated as a dacryocystitis. The only method by which relief may be obtained is by thoroughly opening the sinus externally, cleaning out the ethmoid cells which are always concurrently involved, and obtaining free drainage through the nasal chambers. Before performing a radical external operation for frontal empyema on a child it is well to remove the entire group of ethmoid cells.

In children the antrum rarely requires external operation, as opening through the lateral nasomaxillary wall, the irrigation is usually sufficient to cure the suppuration. In the absence of diseased osseous tissue or new growths, external operation is never indicated, a large opening through the pars membranacea giving better results in every way than a Caldwell-Luc operation. In young children, operative work on the maxillary antrum must be performed with great caution on account of the relation of the teeth at this age, as such procedures during the formative period of the teeth are apt to result most disastrously.

In conclusion, as a result of my experiences, I believe that in young children radical external operative procedures for the relief of purulent sinusitis are infrequently indicated, and are not as productive of satisfactory results as intranasal procedures, and while the same may be said of older children, yet when the sinuses approach the adult type the same indications for treatment and operative procedures apply as in the adult.

BRAIN INFECTION FROM SINUS DISEASE

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Although for a long time otitic brain infections have been known and studied throughout the world, it is only of late that attention has been paid those of nasal origin, in spite of the fact that such cases have been observed in every large clinic. During a recent trip through Europe, the writer had occasion to discuss the subject with many of the leading men abroad, and was astonished at the large number of fatal accidents that had occurred in many of the prominent clinics. Alas! these cases are often not reported abroad, and seldom in this country. I know of a large number of fatalities in my own city, but have yet to see them published.

The question of interest is: In what way is an infection carried to the cranial cavity after any operation on the nose or throat, or even without an operation? There are four possibilities: (1) It may be propagated by continuity; (2) by way of the blood-vessels; (3) by way of the lymphatics; (4) by way of the lymphatic sheaths of the olfactory nerve.

Hajek directed attention to the possibility of brain involvement resulting per continuitatem even though the bones and dura mater may appear intact on *macroscopic* inspection. In one case published by him he proved the correctness of this statement by *microscopic* examination. He and Hinsberg also demonstrated the second mode of infection, namely, the transmission of the micrococci through the blood-vessels. Hajek had previously found streptococci in the veins in rhinogenic endocranial infection, and later this observation was corroborated by others.

Of great importance as regards the third mode of possible infection are the experimental researches of Zwillinger of Budapest on animals and men. His studies on the lymphatics of the upper portion of the nose and their relation to the perimeningeal lymphatic cavities resulted in the following conclusions presented by Zwillinger at the last International Medical Congress, held in London, and kindly communicated to me by the author:

1. The relation of the perimeningeal spaces of the subdural and subarachnoid space with the lymphatic network of the mucosa

of the frontal sinus by way of the nasal mucous membrane in animals (rabbits) is a matter of knowledge.

2. The direct relation of the perimeningeal lymph spaces with the lymphatic network of the mucosa of the frontal sinus has been demonstrated.

3. The relation of the perimeningeal lymph spaces with the lymphatic network of the mucosa of the frontal sinus by independent routes passing through the bones has also been determined.

4. Anatomical evidence of the relation of the lymph channels of the mucosa of the frontal sinus with the lymph spaces of the central nervous system in human beings has also been adduced.

5. The paths concerned in the occurrence of intracranial and cerebral complications of the frontal sinus comprise, besides those already known, the lymph channels of the mucosa of the frontal sinus, which are in direct relation with the perimeningeal lymph spaces.

The fourth possible channel of infection is by way of the lymph sheaths. In view of their anatomical features, they should constitute the best reservoir for all invading bacteria (Miodowski). In a case of postoperative meningitis, Killian was able to *macroscopically* demonstrate the path of infection from the ethmoid cells upward, but the *microscopical* proof was lacking. Such evidence has but recently been afforded by Felix Miodowski at the clinic of Professor Brieger in Breslau. Miodowski supplied the missing link, namely, the histological proof of the infection ascending along the sheath of the olfactory nerve. This was shown in three cases of submucous resection, and thus we are safe in stating that he has established this fact positively.

When an infection is once carried into the cranial cavity, no matter by what path, it is generally the frontal lobe that becomes involved, and it is either its basal portion, or the anterior or median region that is affected. If pus is formed, it may go its own way, as, for example, through the orbit, or, as in the case of Westermeyer, from the antrum through the pterygo-palatine fossa to the brain.

Very peculiar is a case published by Hansberg, in which the right frontal sinus was affected (pus). The patient died, and it was expected that an abscess would be found in the right frontal lobe. Instead an old abscess was present in the *left* lobe. The right ethmoid cells were necrotic, while on the left side there was only a thickening of the mucosa of the frontal sinus and ethmoids.

It is therefore likely that the infection found its way from the mucosa of the left frontal sinus to the meninges through the blood-vessels. (See also Oppenheim and Cassirer).

In many other instances such small abscesses have not been recognized intra vitam, as they do not manifest symptoms. The diagnosis of rhinogenic brain complications, therefore, is occasionally extremely difficult. The reason for this is not alone the smallness of an abscess, as in the above case, but often, as Gerber has pointed out, it is attributable to the fact that the primary affection of the sinus may be latent and may not give rise to any symptoms whatsoever, and for that reason an examination of the nose is often omitted. Finally, we must remember that a fully developed rhinogenic meningitis is in no way different from any other form of meningitis, so that for this reason also a case may be overlooked.

We now come to the most important question: When shall we operate? As regards acute cases, the idea has prevailed that almost every one of them improved without operation. This does not coincide with my experience. Too many cases have returned for treatment after they had been successfully treated by others, as well as by myself. Sometimes an increase of an existing coryza or a slight attack of influenza has caused a lighting up of an empyema that has been considered cured. (Or are these symptoms only due to an outbreak of a latent empyema?) In some instances this process recurs once or twice a year, and the case may go on indefinitely. Such cases, and others of similar character, are not so very rare as is generally believed. In still other instances the symptoms become suddenly so grave that an immediate operation is indicated.

All these cases point to the fact that the process is often latent, giving rise to no symptoms. If such a large number of unrecognized latent cases were not going around, how would it be possible for so many pathologic changes to be found in the sinuses at autopsies? George F. Cobb of Buffalo reported several deaths in the course of latent sinusitis, so that there is reason to seriously consider a radical operation at any time. And yet, in spite of all these arguments, operation should not be resorted to in the majority of these cases. The policy indicated here is as in acute mastoiditis. While in the latter a simple incision into the membrana is very often sufficient, in the sinuses the removal of pus by lavage or other minor means will establish drainage and cure a large percentage of cases. Bulging of the eye, edema of the lids or

upper lip, persistent fever, persistent severe headache, not to mention brain symptoms, are indications for immediate radical intervention.

When we have to deal with a *chronic* empyema, the decision is much more difficult. Every operation of the frontal sinus, for example, has to be considered as dangerous. Right here I wish to emphasize the fact that the results of operative procedures on this sinus are most satisfactory. I have had two cases that left the hospital on the fourth day after the operation, and were completely cured in a remarkably short time. At a meeting of one of the local medical societies, I presented ten consecutive cases of operation for chronic frontal sinusitis that had recovered in a very satisfactory manner. In the next case operated on, the patient, a strong, healthy woman aged 27, died of brain infection. Keeping that last accident in mind, I would ask: Shall we postpone an operation so long that perhaps the pus breaks through into the bulbus spontaneously or forms an abscess in the frontal lobe, with a fatal termination, or shall we leave the decision to the patient? The last proposition is considered the wisest by many, but I absolutely condemn it. A patient, no matter how intelligent he may be, is never in a position to judge what is best for him. We have to do that for him and take our chances. True enough, a radical operation is not always a radical cure, and in some instances the patient may succumb to an operation. But if you watch a chronic case carefully you will be able to judge whether or not it is necessary to operate. Symptoms like those mentioned above, in referring to acute or latent cases, will have to be considered also as strict indications for radical intervention.

But take a case with a chronic purulent discharge and occasional headaches which may at times become quite severe. If the patient is anxious to get rid of his trouble, or if he cannot properly follow his vocation on account of its presence, he will readily submit to the radical operation proposed by you. If these same symptoms, however, do not impair the patient's health, I should hesitate to suggest an operation, for such patients would rather endure all these slight ailments than take even a remote risk of dying soon after its performance. As much as it is our duty to insist, with all our authority, on immediate intervention in cases with the urgent symptoms mentioned above, there is no justification for persuading a patient to undergo a radical operation in a case like the one just mentioned. It requires large experience, good judgment and careful attention on the part of the physician

to determine when to operate, and the best men may occasionally disagree as to its necessity.

In presenting the histories of some of the cases seen by me, you will note that some of the patients who died after operation might have been saved if it had been performed earlier, while others might still be alive if it had not been done at all.

Permit me first to report some cases of cerebral infection of *dental* origin. Although this class does not strictly come within the scope of our theme, they have all been referred to my service at the hospital, and similar ones have probably come under your own observation. Besides, the infection often spreads through the sinuses before affecting the brain. In this category, however, are not included those chronic empyemas of the antrum due to carious teeth. These cases have been recognized for many years; in fact, ever since the beginning of our knowledge of sinus disease. What I am alluding to are the acute infections following extraction of teeth, and of that class I have seen an unusually large number. This is due to two factors: The hospital to which all these cases were brought is situated in the poorest and dirtiest part of Manhattan, and it is more than likely that these persons were infected in their own tenements. Moreover, many of these infections were undoubtedly due to negligence on the part of the dentist. This is not an accusation against American dentistry, for we all know that its achievements have been remarkable. American dentistry is superior to that of all other countries, and we laryngologists who have adopted many an instrument and device invented by dental surgeons fully appreciate that; but that many dentists utterly neglect all asepsis is a matter of common knowledge. Of course, an infection may occur in spite of the utmost care, but I have seen many cases in which the dentist was not free from responsibility. Let me give you an example:

Case A.—E. B., a poorly nourished child, aged 6, had suffered from toothache several days before admission to the hospital. A tooth was extracted two days later, and very soon afterward the face began to swell. Pus was discharged from the socket, the face became painful and continued to swell more and more, together with the lips and the eye on the affected (left) side. Fever was present. On admission, the child was stuporous; there was strong fetor *ex ore*, and marked swelling of the face, which now extended to the right side, so that both eyes were closed. Large amounts of purulent discharge. Temperature 104.2 F., pulse 150-180, respiration 36 to 44. The general condition grew worse constantly. To reduce the very pronounced cellulitis, several incisions were made but no pus was found. Death occurred from

septicemia three days after the operation. The report of a physician, who happened to be present at the time of the extraction of the tooth, leaves hardly any doubt that the infection was to be attributed to the carelessness of the dentist.

Another case very similar to the one just mentioned occurred last summer:

CASE B.—Sam W., aged 40, storekeeper, admitted June 9, 1913. Sudden onset of chills and fever after tooth extraction; restlessness, delirium, swelling of cheek, anorexia and constipation.

His present illness dates back to seven days before admission, when patient, after having had his second upper bicuspid tooth extracted, was suddenly seized with chills, followed by high fever recurring practically every day, swelling of right side of face and upper part of right side of neck, restlessness and delirium; the last had been almost constant for past three days except when asleep, and was of a maniacal character. He did not ask for food, but seemed very thirsty. There were no urinary or respiratory disturbances.

Operation the same day. The antrum was opened and a great deal of pus was found. The same condition was present in the frontal sinus. There was a defect at the upper inner wall through which the dura was bulging. On incision, pus was evacuated. On following day, *exitus letalis*, due to septicemia. In this case of abscess of the brain, a colleague witnessed the extraction of the tooth, and he too volunteered his opinion as to the absence of asepsis.

The clinical picture is different in a number of other infections of dental origin. In these cases the sinuses are not involved and the infection most likely is transmitted by way of the lymphatics to the meninges and brain. It is quite useless to open the sinuses, as one would find nothing pathologic macroscopically. All these cases give an absolutely bad prognosis.

Of much greater importance are the cases of brain infection originating in the *accessory sinuses*, and of these the most prominent are the affections of the frontal sinus. Patients with empyema of this or the sphenoidal sinus are in constant danger whenever there is insufficient drainage. Even with drainage established, the sinus may close up at the slightest provocation and retention of pus with its sequelae may ensue. For that reason, such patients should be under constant supervision. Fortunately, Nature assists in many instances; but, as physicians, we cannot rely on mere luck or Nature. It is of prime importance, therefore, to decide when to advise a radical operation in these cases. With that idea

in view, some cases are narrated here, ranging from the simplest to the most complex:

CASE 1.—S. A., aged 29, merchant, has not been able to breathe through his nose for the last three years. Left-sided headache at times, and discharge. He had seen several specialists, and had had the septum straightened and both middle turbinates removed. The diagnosis of chronic empyema of the left frontal sinus is positive. In spite of the advice of his family physician, I did not urge the necessity of a radical operation, and the empyema has remained in about the same condition for the last two years.

CASE 2.—Mrs. L. R., aged 48, had suffered from "catarrh" for many years. After an acute tonsillitis, there appeared a profuse mucopurulent discharge from the nose. This ceased a few days ago, and since then there has been severe frontal headache and slight rise in temperature.

Diagnosis.—Acute empyema of left frontal sinus and right antrum. The left turbinal was removed immediately, but the patient felt worse. Headache more intense, and total loss of appetite. Washing out the sinuses gave little relief. As the daughter of this patient is a physician, she could watch the case carefully. More than once in the course of the next ten days I was tempted to advise radical operation, when one day there was an immense discharge of pus, and patient experienced immediate relief. She has been well for half a year. No doubt the opening of the frontal sinus was clogged higher up, and patient was in danger until it was freed.

In marked contrast to this case is one reported by the writer in the fall of 1908, the history of which may be briefly recorded again:

CASE 3.—The patient, a woman aged 25, came to the clinic with an acute suppuration of the right frontal sinus. The middle turbinated body was not removed because her family physician objected! Several weeks afterward she returned with edema of the eye and cheek, retention of pus, vomiting, etc. Operation revealed an abscess of the frontal lobe, of which she died four days later. There is little doubt that this woman's life would have been saved by an early operation on the frontal sinus, or perhaps by the simple removal of the turbinal.

I shall not mention the cases reported by me in 1910, which can be found in *The Laryngoscope* (January, 1910), but ask permission to describe several new cases which I think you will find of great interest:

CASE 4.—Stanislaus K., aged 35, chef, was referred to me through the kindness of Dr. D. of this city on April 8, 1913. Patient said that he had recovered from an attack of appendicitis a week ago. A few days after his head ached over the right temple, the pain spreading to the center and then to the back of

the head. The nose was free. Dr. D. had seen him on April 4, and examination of the eyes disclosed the following conditions: Conjugate deviation of the eyes to the right. R/L + 0.5; V = ½; presbyopia, 3D. Ophthalmoscopically: Slight congestion of both optic nerves, with hyperemia. R. and L. field normal; no scotoma; no enlargement of blind spot.

As the doctor had some suspicion in regard to the accessory sinuses, he sent the patient to me. The man was led into my office by his wife, his gait being unsteady. In walking he leaned toward the right. (He said that he also felt dizzy while lying in bed.) In walking, he butted into objects to his right. On examination an acute right frontal sinusitis was found and the sinus was irrigated. Some pus was evacuated and the patient felt easier immediately.

April 10; part of right middle turbinate removed; daily irrigations of sinus. April 11; could not move his eyes to the middle line; this occurred after syringing the sinus. April 17; vomited and felt worse, but after the syringing was better again; the question of a radical operation was seriously considered, but patient did not consent.

At the beginning of June, 1913, I saw him for the last time, when his condition had improved remarkably. Dr. D.'s report of June 15 says: "Conjugate deviation as well as congestion of optic nerves has disappeared. Pupils and muscles were always normal, namely, no paralysis."

Diagnosis: Some local focus beyond the corpora quadrigemina. Embolus or frontal sinus affection?

The writer is inclined to attribute the whole process to the frontal sinus primarily. What followed afterward is difficult to decide; whether it was a mere pressure on the frontal lobe or meningitis will probably be determined later, for sooner or later the symptoms will again recur. The writer does not know the patient's whereabouts since June, and would be thankful for any information.

Case 5.—Miss J. S., aged 25, was referred to me by Dr. Henry S. Oppenheimer. She complained of pain in the eyes and in the middle of the forehead, for which she had consulted several oculists. Dr. Oppenheimer did not find any cause for the pain in the eyes, and sent her to me.

Diagnosis: Chronic empyema of left frontal sinus and left sphenoidal sinus. The Roentgen ray plates showed cloudiness over both frontal sinuses and over the region of the anterior ethmoid cells. "The frontal sinuses are small, but very deep in the anteroposterior direction. The sphenoidal cells are apparently small, but the air spaces are not occluded." We shall see that this latter statement was erroneous.

The usual treatment was inaugurated, namely, the establishment of drainage for the left frontal sinus and sphenoidal sinus,

with the result that the patient felt better while under treatment. Then she was sent to the mountains for three months. On her return she was like another person; no pain, no discharge, and appeared perfectly healthy. In the middle of the following winter, however, the old trouble recurred, and the latent empyema again became active. At this stage a radical operation was advised, but was refused on account of the possibility of a scar. In the summer of 1912 she again went to the mountains, and returned apparently well, only to show the old symptoms again in the winter of 1912-13.

Finally, in April, 1913, the family decided to have the operation performed. That was about a year and a half after I had first advised it. On April 2, 1913, the left frontal sinus was opened, and it was found to have a wide communication with the other side. The dura was exposed at two places on the inner wall, but appeared normal. The left sphenoidal sinus was of enormous size.

April 5. Patient felt quite comfortable, although always restless, but night before became unconscious; temperature 103-104 F.; pulse 74-80. April 7. Very restless; right arm apparently paralyzed; in left arm, clonic cramps. April 8. Convulsions of right side of face; stiffness of neck, pupils narrow, little reaction; Babinski positive; lumbar puncture showed high pressure and dark fluid. April 13. Eleven days after the operation, *exitus letalis*. Autopsy not permitted. From the clinical symptoms there was reason to suspect meningitis, and perhaps a thrombus in the sinus longitudinalis.

Epicrisis.—Here we have a case that at no time developed severe symptoms and at no time gave urgent indications for immediate operative intervention, yet on account of the constantly recurring symptoms, the chronicity of the case and the impossibility of curing the disease by intranasal operation (septa in the frontal sinus) the writer advised radical operation. If this had been done at that time it is probable that we would have found the inner wall of the frontal sinus intact, and might have saved the patient's life.

It may be added that the Roentgen ray findings are of interest. At the operation, the sphenoidal sinus was found to be of extraordinarily large size, while the skiagraphs indicated a small sinus. The frontal sinuses, on the other hand, were small, but the anteroposterior diameter was very great on the skiagraphs. Is there a possibility of the sphenoidal sinus "overshadowing" the frontal sinus?

In connection with this, I shall mention two other cases, the histories of which are not yet published but were given to me by

Professor Herzfeld of Berlin during the summer. I shall present only excerpts of these interesting cases.

The first one was a man aged 57, who had sustained a trauma at the inner angle of the right eye at the age of 14. After several years this finally healed, but eighteen years later he was again injured in the same region. A fistula formed which discharged pus from the right frontal sinus for seventeen years. At an attempt to close this fistula, it was found that the anterior wall of the frontal sinus was absent, due to the traumatisms and former operations on the sinus. Furthermore, it was observed that the cerebral wall of the *left* frontal sinus had a small defect, with a normal looking but bulging dura. After the operation there was a rise in temperature and *exitus letalis.*

The remarkable points are that the patient's mind was absolutely clear, that he was up and about, without any complaints, and that only two hours before his death coma suddenly set in. The meningitis seems to have been produced by continuity through a defect found in the dura at the autopsy, a defect that could not be detected macroscopically seven days previously at the operation. Herzfeld mentions especially the seat of the defect on the left side, that is, the side affected only secondarily. This has been noted in other cases, as we have already shown.

Herzfeld's second case was a man aged 29, who had suffered from purulent discharge all his life. Suddenly, an acute exacerbation, with fever, edema of the eyelids on both sides, etc. Operation showed a periosteal abscess and empyema of the frontal sinus. After the operation the temperature became high, and there was some headache, stiffening of the neck, etc. For these reasons, a second operation was performed. After the cerebral wall of the frontal sinus was chiselled away, a mass of fetid pus was evacuated (epidural abscess). The same night, *exitus letalis. Autopsy:* Purulent meningitis. "If the epidural abscess had been recognized and opened sooner, the patient would probably have been saved. The persistent headache and high temperature after the first operation perhaps pointed likewise in that direction."

From such histories we can learn a great deal, and in the interest of scientific progress it is desirable that every one should publish his cases.

In regard to suppuration of the sphenoidal sinuses, mention should be made of central scotoma as one of the early symptoms of cerebral involvement. This was demonstrated in a case pub-

lished by the writer in 1910 (*loc. cit.*), as well as by W. Schulze (Passow's Beitrage, page 48, 1911).

In conclusion, the writer would say that he has operated on a great many cases of suppurative sinus disease — over 150 of frontal sinus affections alone — and that his death-rate has been remarkably low. In the last mentioned class he had only six fatalities. In spite of this, the so-called radical operations on the frontal sinus must be considered as dangerous and should be undertaken only after very careful deliberation. That even then mistakes will occur has been shown in more than one instance. Some cases will die of postoperative meningitis which might have survived for years with a defect in the cerebral wall, while others will die if the operation is postponed. These and other problems will have to be solved by the combined efforts of all laryngologists. Their work will, we hope, clear up this very interesting question of rhinogenic brain involvement.

For Discussion see page 390.

INTERPRETATION OF THE PRESENT TEACHING OF THE VIENNA SCHOOL IN REGARD TO LABYRINTHITIS AND CEREBELLAR ABSCESS OR ABSCESS AND MENINGITIS OF THE POSTERIOR FOSSA

(SYMPOSIUM ON THE LABYRINTH)

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The part of this symposium which I have assumed is the endeavor to interpret the present teaching of the Vienna school in regard to labyrinthitis and cerebellar abscess or abscess and meningitis of the posterior fossa. It is especially my purpose to make clear to you the difference in identical symptoms in the various diseases, together with consideration of the other important symptoms which go to make the diagnosis. As usual, the task is too long for a few minutes, but something can be done. Let us run over some essentials for a few moments.

It is insufficient to note the presence of nystagmus; its plane and direction are absolutely essential, as will be shown. The opaque glasses must be used because behind them the nystagmus shows great changes, impossible to observe without them. The Barany noise apparatus must be used to determine absolute deafness. The reactionary body movements (Rhomberg phenomenon) and spontaneous pointing errors must be painstakingly watched; also the caloric test and its influence on these and the direction of the nystagmus. The position in bed should be taken note of, as it is governed by the law that voluntarily holding the eyes in the opposite direction to the quick component of the nystagmus lessens it and the accompanying symptoms, vertigo, nausea and vomiting. This happens, that in looking around the room from such position, patients find themselves more comfortable. It may become necessary to look at the optic disks for swelling, to make lumbar puncture, to look for ataxia of the arms, the Babinski sign and paresis of associated eye movements to the diseased side. Lastly, pulse, temperature, headache, stiffness of the neck, consciousness, stupor, humor and the general aspect must not be lost sight of for otherwise correct conclusions will not be obtained. If I can drive these few points home, my mission before you to-day will have been accomplished. Practice is neces-

sary for quick, correct observations; therefore, let me urge you to lose no chance to study these interesting cases closely. They are the gravest we have to handle.

Let us first take up circumscribed disease of the vestibular apparatus. The complaint is attacks of vertigo. They are accompanied by spontaneous nystagmus and perhaps nausea or vomiting. The nystagmus is horizontal and rotary and directed to the diseased side, as a rule, but may be to the sound side. We may, however, never see the patient during an attack, and as smokers and persons with bad stomachs, neurasthenics and those suffering from circulatory disturbances, namely, arteriosclerosis of the brain arterioles, the menopause, and even persons otherwise perfectly sound, have slight attacks of vertigo, some difficulty arises unless we remember that in a true circumscribed disease of the vestibular apparatus, cochlear symptoms (tinnitus and hardness of hearing) will probably be found when the lesion is situated anywhere from the peripheral ending to the entry of the vestibular nerve in the medulla. Neurasthenics show all the symptoms of the disease; tobacco may be withdrawn, bad stomachs treated and last, arteriosclerotic patients rarely have the cochlear symptoms. The attacks are of two kinds: first, attacks from no precipitating cause whatsoever, lasting from half an hour to several hours, recurring quite frequently, and usually accompanied by nausea and vomiting; second, attacks caused by quick head movements, inclining the head backward, especially toward the diseased side, by quick turning or shaking of the head, bending forward and straightening up, etc.

In labyrinthine fistula either kind of attacks occur. Generally, however, in these cases there are cochlear symptoms, hardness of hearing up to complete deafness, and tinnitus, either or both. When the lesion causing the vestibular disturbance is located within the medulla, in the region of the posterior long bundle upward to the nuclei of the eye-muscle nerves, cochlear disturbances are improbable. The reaction to the caloric and turning tests is positive. These facts are mostly from Barany.[1] To my mind, the fistula presents the most graphic picture of circumscribed labyrinthitis, though we must remember that disease of the bony capsule does not necessarily imply disease of the membranous or real labyrinth. When, however, there are cochlear symptoms, the membranous labyrinth is diseased and in constant danger of destruction.

1. Physiologie und Pathologie des Bogengang Apparates, 1907.

Fistulas can heal anatomically, especially after the radical mastoid operation (carefully done) without physiologic healing. That is to say, the fistula symptoms may remain up to a year afterward and the cochlear always, though the opening has closed.

The attacks of vertigo may be so severe and frequent as to endanger the going about, especially in a city, or may so incapacitate one that the question of operative destruction of the labyrinth may well be entertained; but certainty of diagnosis must first be established. A retrolabyrinthitis, that is, disease of the vestibular apparatus within the cranium, or vertigo with nystagmus, as above, from other causes, must not be mistaken for disease within the labyrinth. It must be rare for any one to see the latter cases associated with acute or chronic suppurative otitis media. Fistula can occur with either acute or chronic otitis media and in children distinct intracranial symptoms are sometimes seen with nystagmic eye movements, but these are frequently relieved by simply opening the ear drum; thus we cannot be easily misled.

Just here let me remind you of double circumscribed labyrinthitis, with or without fistula on one or both sides, or a dead labyrinth on one side and circumscribed labyrinthitis, with or without fistula, on the other. The above cases will hardly confuse one accustomed to examining the vestibular apparatus frequently, especially one who habitually examines both ears.

It is not good judgment to operate on one ear when the other is in danger of destruction by disease.

Trauma causes circumscribed as well as complete labyrinthine destruction. As it has a special interest, let us consider it briefly, and then pass on to the consideration of the diseases in which the symptoms are much alike, but showing differences on closer inspection.

Some are genuine and some are malingerers, and whereas vertigo is their usual complaint and consequently many of these go to the courts, we are called on to determine the facts. When the injury is severe enough to destroy the labyrinth, these unfortunates complain of strong vertigo with nausea and vomiting, immediately on regaining consciousness.

Horizontal and rotary nystagmus will be found directed to the sound side. The side opposite to the direction of the nystagmus will be found completely deaf by the use of the Barany noise apparatus in the good ear. The caloric test will be negative on the diseased side. This test must not be made with water if the ear drum is ruptured. With this group of symptoms the

diagnosis of a destroyed labyrinth is positive. The second type is comprised of those patients who, so long as they remain quietly in bed, have no vestibular symptoms, but immediately on arising complain of vertigo. Hearing is good and there is reaction to the caloric test in both ears.

If the patient can be examined for nystagmus and reactionary body movements during an attack, very positive information can be gained. Failing this, we must use the turning test to identify the vertigo complained of. First, produce the horizontal nystagmus. If the patient states that the accompanying vertigo is like that which occurs during the attacks, the statement is false. When with the head inclined 90 degrees forward a rotary nystagmus is caused by turning, the immediate identification of the vertigo is so spontaneous that all thought of deceit is gone. Frequently such patients are so bothered by this condition that in time they become neurasthenics. In such case you will find that ten turnings cannot be put up with, two or three being sufficient to produce marked nystagmus and disturbances of equilibrium, together with trembling of the whole body, outbreak of sweat, palpitation of the heart, and sometimes imperfect cerebration, and other signs of nervous instability.

DIFFERENTIAL DIAGNOSIS — CHANGES IN LIKE SYMPTOMS IN DIFFERENT FORMS OF LABYRINTHITIS

We come now to the consideration of the changes in symptoms in suppurative labyrinthitis, acute, subacute and latent; serous labyrinthitis, cerebellar abscess and meningitis of the posterior fossa. All of these diseases show several symptoms in common, but in each there are differences sufficient for diagnostic purposes, not always without the greatest care, indeed, for here we are in deep water.

Spontaneous horizontal and rotary nystagmus is common to the whole group, but the direction and degree are very different. In acute suppurative labyrinthitis the process suddenly destroys one labyrinth, disturbing the equality of tonus impulses between the two sides, causing a strong nystagmus directed to the sound side. In subacute labyrinthitis, meaning by this after the storm has passed, a certain amount of readjustment has taken place, the nystagmus becomes weak and is directed to both right and left equally. In the latent, spontaneous nystagmus may be absent or only found when the eyes are moved to the extreme lateral position voluntarily. Even then it is very weak and directed to

both sides. If intracranial complication follows the suppurative labyrinthitis, the greatest impulse may be generated from the nerve trunk or nuclei on the diseased side, causing the nystagmus to shift to the diseased side. If the intracranial disease spreads so as to involve the nuclei or nerve trunk on both sides, all impulses are stronger than normal and cause strong nystagmus, directed to both right and left. Sometimes, in spite of the complications, the nystagmus remains directed to the sound side. Two things now are manifest: first, the strongest impulse continues for some reason to come from the sound side, and second (a most important symptom), the nystagmus does not diminish. In acute suppurative labyrinthitis, on the contrary, it grows weaker and weaker from the onset, passing to the subacute and latent, and finally to complete readjustment.

In cerebellar abscess, continual increase of nystagmus is so characteristic that finally such a degree of severity is reached as is never seen in other disease.[2] The peculiarity of nystagmus in serous labyrinthitis is shifting. It may be directed to either or both sides, later changing to one or other side, and so on.

During the stormy period all cases must be observed frequently to determine the stability or shiftiness of the nystagmus.

Let us now make our observations of the eyes behind opaque glasses.

So long as the patient looks into them, the rotary element disappears, and only the horizontal remains in acute and subacute labyrinthitis, abscess and meningitis. This is stronger in acute but weaker in the subacute, with loss of the nystagmus to the diseased side in the latter; that is, it becomes more like the nystagmus in acute labyrinthine disease, with the exception that it is very small. In serous labyrinthitis the shifting is increased.

In abscess and meningitis the nystagmus is purely horizontal to one or the other side. If it is possible to note change of a nystagmus already so strong, it is stronger, but the accompanying symptoms, nausea and vomiting, are not so bad — this, at least, is my experience. Suspension of the rotary element probably accounts for this.

Quick head movement always increases the nystagmus in acute labyrinthine disease, even when the storm has abated, but not after it has passed; that is, in a labyrinthitis three weeks old, or often when it is latent. These movements sometimes cause increased nystagmus in serous labyrinthitis, abscess and menin-

2. Neumann: Der Otitische Kleinhirnabszess, 1907.

gitis, and sometimes not. Nausea and vomiting are symptoms belonging to acute processes only.

The reactionary body movement is constantly in the same direction in acute suppurative labyrinthitis, namely, to the diseased side, when the head is erect; forward, when the head is turned to the shoulder of the sound side, and backward, when the head is turned to the shoulder of the diseased side. This is exactly what we find if a normal vestibular apparatus is disturbed by syringing the ear with cold water until horizontal and rotary nystagmus is induced to the opposite side.

The direction of falling in serous labyrinthitis, on the contrary, is very inconstant, on account of the shifting of the nystagmus, but the falling nevertheless follows the rule, namely, falling away from or in the opposite direction to the quick component. When the nystagmus is to the right, with head erect, the patient falls to the left. When it shifts to the left, the falling is to the right. The direction of falling changes with changed position of the head.

Syringing the sound ear with cold water in acute suppurative labyrinthitis corrects the falling reaction; that is, there is no falling so long as the caloric influence lasts. Syringing the sound ear with cold water in serous labyrinthitis will be very different if the nystagmus is to the diseased side. The falling reaction will be so intense that the patient cannot stand long enough to make the test. In other words, the most intense reaction takes place. When the nystagmus is to the sound side, the reaction is the same as in the acute. We must, however, remember the possibility of shifting during the test, and make the test again, if necessary.

This is the fourth in the series of marked differences in the same symptom in acute suppurative and serous labyrinthitis, both, of course, uncomplicated. The first is changing of the spontaneous nystagmus; second, shifting intensified behind opaque spectacles; third, shifting of the reactionary body movement (Rhomberg) with change of direction of the nystagmus; and fourth, influence of the caloric test.

In abscess and meningitis the direction of falling may or may not follow the rule of falling away from the nystagmus, in a given case. Herein they differ from acute suppurative and serous labyrinthitis. However, there is a differential value only when the rule is not followed.

Another difference in a symptom common to both acute, suppurative and serous labyrinthitis is the spontaneous pointing

error. In the first-named disease there is spontaneous pointing error in all joint movements to the diseased side (vertical movements), arm on diseased side down, other arm up (horizontal movements), whereas the spontaneous error changes with change of direction of nystagmus in serous labyrinthitis.

Abscess and meningitis just here show their first great common difference. The arm points to the diseased side, whatever the direction of the nystagmus. Syringing the sound ear with cold water corrects the pointing error in acute suppurative labyrinthitis always, and also in serous labyrinthitis, when the nystagmus is to the sound side. On the contrary, it has no influence in abscess and meningitis. The latter fact is positive and very valuable. The caloric test is important in all cases, because in any suppurative case of diffuse labyrinthitis the caloric, hot or cold, in the diseased ear is negative. The reaction in subacute and latent labyrinthitis is much reduced in the good ear. Serous labyrinthitis, it must be remembered, is not destructive, consequently the diseased ear may show some reaction. Both abscess and meningitis of the posterior fossa occur, and not infrequently, in the course of suppurative otitis media without labyrinthitis. In such cases the caloric test is positive in both ears. Hearing is lost in diffuse suppurative labyrinthitis, but in the serous it may be found to some extent, even during the stormy period, and, as a rule, improves with time.

In abscess and meningitis uncomplicated by labyrinthitis there is hearing in both ears. For further differentiation we must look to more general symptoms. Temperature and pulse are normal in all uncomplicated cases of suppurative and serous labyrinthitis. While in abscess the temperature tends to the subnormal, with slow pulse, in meningitis there is also a slow pulse, but the temperature is up but usually not very high.

Headache is not a symptom of labyrinthitis, but is very marked in abscess. It is located in the occiput, or projected to the forehead, and constant. In meningitis it is a variable symptom, even to the point of being absent. Stiffness of the neck, while considered characteristic of meningitis, may not be present therein, and may be in abscess. Consciousness is normal in all except late in abscess and meningitis. Humor is good in labyrinthitis, but bad in abscess and meningitis and is usually worse in the former. Sleep tendency is little affected by labyrinthitis. Abscess patients sleep a great deal, but meningitis patients not so much; that is, the tendency is greatest in abscess. In acute suppurative

and serous labyrinthitis and abscess the patients are manifestly very ill. The aspect in meningitis is variable with the severity of the case. Position in bed is always on the side of the quick component of the nystagmus, and is only characteristic during the active period of symptoms; therefore, in acute suppurative labyrinthitis the patient is always found on the sound side, while in the serous the position shifts with the direction of the nystagmus. In abscess and meningitis the position differs in different cases, depending on the direction of the nystagmus. A summary would be but repetition.

I have written in the beginning the equivalent of a summary, to call to the reader's mind, first, what to watch for. Some symptoms have been only mentioned and others not considered, as they are unusual, belonging more to the differentiation of other intracranial diseases from those mentioned. Of course, meningitis and abscess sometimes manifest other symptoms, or meningitis may be circumscribed or diffuse, serous or suppurative, and any of these forms may complicate abscess, probably thus accounting for the temperature in some cases, except the primary fever and chill which sometimes usher in the abscess. Abscess of the middle fossa may have to be excluded. In the difficult cases in which all possible symptoms must be weighed, it will be necessary to consult the works mentioned in the body of the paper, and other writings, especially those of Barany, Neumann, Alexander and Ruttin in home and foreign journals. The Americans who have written on the subject lately have been mostly students of this school, and most of their works are valuable. As indicated at the outset, I have drawn from the authors mentioned only.

PATHOLOGY AND OPERATIVE TREATMENT OF LABYRINTHITIS

(SYMPOSIUM ON THE LABYRINTH)

JOSEPH C. BECK, M.D.
CHICAGO

In order to present the subject of surgical pathology of the labyrinth, it is necessary to study the gross as well as the minute or histologic structures.

Since surgical labyrinthine diseases belong to the most modern work on otology, and since the cases so diagnosed are small in number in any one's individual practice, the author has collected all the material in the literature at his disposal and herewith presents a resumé.

Ruttin's case reports, in his "Klinik der serösen und eitrigen Labyrinth-Entzündungen," which comprise the majority case reports (108) in the Vienna clinic, offer excellent information regarding pathology as determined at operation and post mortem, but are sadly lacking in illustrations.

In the English work of Braun and Friesner on "The Labyrinth," one finds a very concise and clearly expressed subject of the pathology of suppurative labyrinthitis, containing excellent illustrations of sections of the labyrinth.

In Uffenorde's "Zur Klinik der Eiterungen des Ohrlabyrinths" there are a number of case-reports, which, from their pathological and therapeutic side, are of great practical value. The scientific portion of the book is devoted to experimental labyrinthitis in which a number of sections are illustrated.

The masterful work of Panse on "Pathologische Anatomie des Ohres" contains the richest pathologic literature, particularly concerning the histologic aspects. There are thirty-four illustrations of the histologic sections of infectious labyrinthitis.

The third edition of Brühl's "Ohrenheilkunde," which is a text-book and atlas combined, contains beautiful illustrations especially in colors of gross and histologic specimens of labyrinthine disease.

The American text-books on the ear, such as those of Ballenger, Phillips and Kerrison, and the papers of McKenzie on "Labyrinthine Studies," are sadly lacking in reference to the pathologic side of labyrinthine disease.

From the files of the *Index of Oto-Laryngology*, in which, since its inception in 1911, has appeared a monthly classified index of the otolaryngological literature of the world, I have collected from 125 to 130 articles on this subject alone, and very little more can be added to what has appeared in the above-mentioned books.

The writer then demonstrated sixty-two slides of the various pathologic conditions of labyrinthine disease. These slides are copies of the illustrations appearing in the books and articles consulted, and represent the following lesions:

Series 1. Diffuse serous labyrinthitis.

Series 2. Diffuse suppurative labyrinthitis.

Series 3. Circumscribed labyrinthitis and fistula.

Series 4. Sequestration of labyrinth, with either a circumscribed suppurative, diffuse suppurative or diffuse serous labyrinthitis.

Series 5. Fibrosis with atrophy of membranous labyrinth.

Series 6. Complete osteofibrosis.

Series 7. Experimental labyrinthitis.

The author's own observations are limited to a study at the time of operation of six cases, all of which were of the diffuse suppurative type. Two presented complete necrosis with sequestration of temporal bone. The others showed, on being opened, the presence of pus.

OPERATIVE TECHNIC

In regard to the operative technic, the author demonstrated six procedures:

1. Hinsberg operation.
2. Jansen-Neumann.
3. Neumann operation.
4. Uffenorde's operation.
5. Ruttin's suggestion for Neumann operation.
6. Richard's operation.

After discussing these operations and the points in favor of each, the author reported six cases occurring in his own practice. There were two cases of complete necrosis and it was necessary to clean out everything up to the dura on all sides. Both recovered, but with a facial paralysis which, however, had existed prior to operation, the one for two years and the other for three years.

The next two cases were operated by the Hinsberg method. One died from erysipelas of the operated ear on the tenth day, which developed into a diffuse suppurative meningitis. The other

case recovered, though with a facial paralysis which had existed four months prior to the operation. Subsequently this facial paralysis was corrected by a facial hypoglossal anastomosis. Results were good.

The last two cases were operated by the Neumann method, with the exception of the step which goes completely to the fundus of the internal auditory meatus. Here the suggestion of Ruttin was followed, and the operation stopped short of the fundus. Both recovered.

The following case is reported in detail because of its interesting diagnostic phase:

Case 1.—A man, aged 27 years, was admitted to the hospital with a history of lues sixteen years ago and now complaining of headache, some dizziness, nausea and diplopia.

Examination revealed a paralysis of his right abducens muscle. Right ear discharging pus, patient states for many years. Wassermann was negative. Placed on antiluetic treatment in large doses without any result.

Referred to the neurologic clinic, where patient showed slight disturbance in his gait and spontaneous nystagmus, particularly to the left. All other reflexes normal, and the neurologist now made a diagnosis of a cerebellar abscess on the right side, secondary to his chronic suppurative ear.

He was then referred to the otological clinic for further examination and treatment. The attending otologist, making a hasty examination, believed it to be a case of cerebral syphilis. He made a hearing test by means of tuning-forks and constituted the following findings: that the patient heard in the diseased ear; a prolonged negative Rinné; Weber laterating to affected ear.

I was then called in the case and found the following condition: A poorly nourished man, somewhat dull in expression, but apparently in great pain, which he located toward the back of the head. The eyelids were drooping (no evidence of any ocular muscle paralysis nor nystagmus), pupils were reacting normally, the fundus examination negative; right ear foul-smelling discharge, the remains of the drum membrane thick and swollen, the upper canal wall appeared to be sagging and a small perforation situated in the extreme anterior and superior quadrant; left ear negative. Placing a vibrating fork of low pitch into the left auditory canal, patient could not hear the lowest sound (Norval Pierce test). Reversing the test, fork in right ear, the patient heard almost normally. Irrigating right ear with cold water produced no nystagmus, whereas cold water in the left ear produced a marked compound nystagmus. These tests demonstrated definitely that the right labyrinth was destroyed.

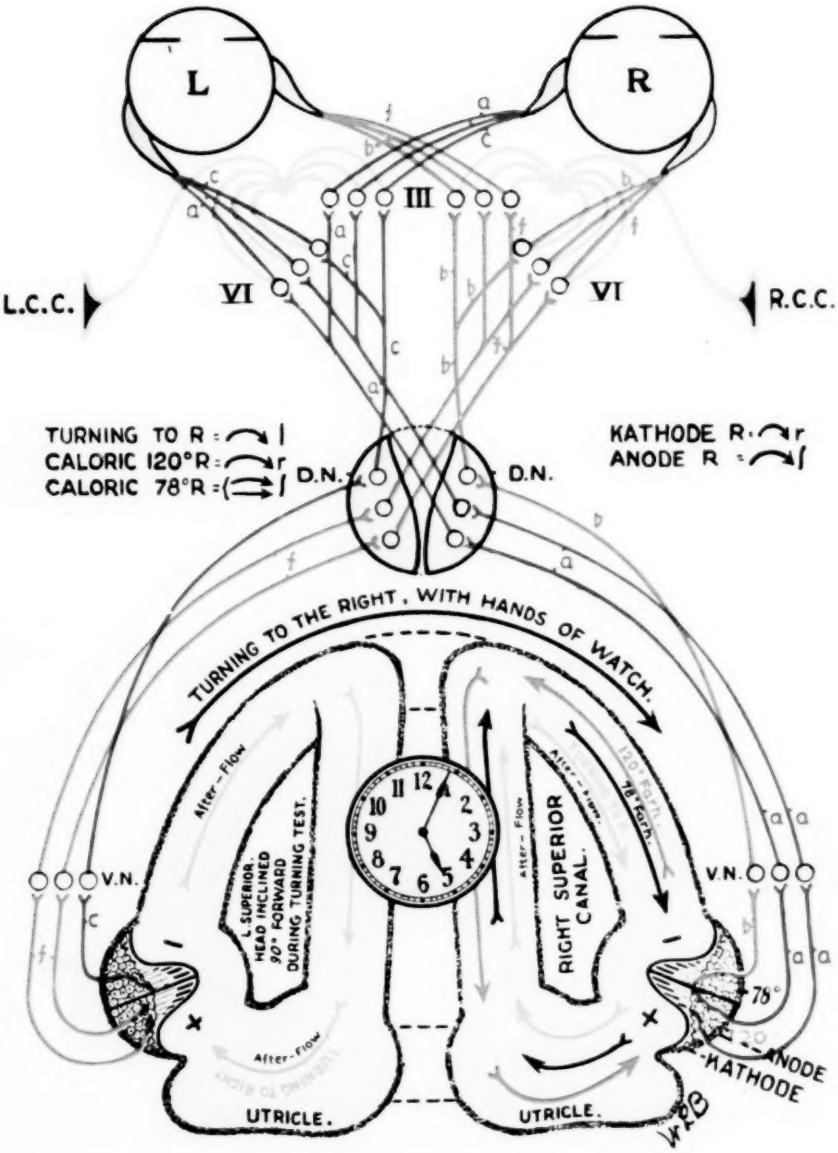
Blood Examination.—Leukocytosis: polymorphonuclear 85 per cent. Wassermann again negative. Spinal puncture: fluid was under normal pressure and clear; Nonne negative. Noguchi glob-

ulin test positive; no increase in the cellular elements. Barany's pointing test negative. Diado-aconesia absent.

Consulting now with the neurologist, we decided that it was not a cerebellar abscess, but a suppurative labyrinthitis, secondary to a chronic suppuration of the middle ear and mastoid and decided on an operation, which I performed, namely, radical mastoid, including Neumann labyrinth operation.

The usual picture of a chronic suppurative mastoiditis was encountered. The horizontal semi-circular canal was intact, as were also the tegmen toward the cerebrum and the sinus wall. Exploration of the middle ear revealed a necrotic promontory of the cochlea, the probable source of infection of the internal ear. The usual technic of the Neumann labyrinth operation was carried out without any difficulty. The electric burr proved a great aid in the technic. The anterior vertical semi-circular canal, when opened, showed pus distinctly.

Subsequent Course.—Patient rallied, pains general, toxic condition, drooping of the eyelids disappeared on the third day. However, patient still complained of being dizzy. On the fourth day the abducens paralysis recurred, as also was apparent a slight facial paresis, both, however, disappearing within the next three or four days. From now on the patient made an uneventful recovery, dizziness completely disappearing at the end of the third week.



Physiological nystagmus to turning caloric and galvanic stimulations

LANTERN-SLIDE DEMONSTRATION OF NYSTAGMUS

(SYMPOSIUM ON THE LABYRINTH)

WILLIAM LINCOLN BALLENGER, M.D.
CHICAGO

Physiologic and pathologic nystagmus in many of its expressions was shown in eleven colored diagrammatic drawings by the author. Only one of the drawings will be published in the Transactions of this Association, as the drawings will appear in the fourth edition of the author's "Text-Book on Diseases of the Nose, Throat and Ear."

The drawing selected illustrates physiologic nystagmus to the turning, caloric and galvanic stimulations.

As the drawing is self-explanatory, a description will be omitted.

THE INDICATIONS FOR OPERATING IN ACUTE MASTOIDITIS *

GERHARD HUTCHISON COCKS, M.D.
NEW YORK CITY

In many cases of acute mastoiditis the indications for operation are perfectly clear. In a large number of instances, however, the surgeon is confronted with considerable difficulty in deciding just when to operate. He desires, on the one hand, to avoid surgical interference if the patient will recover without it; on the other hand, he is even more anxious to avoid labyrinthine or intracranial complications by not unduly delaying operation.

One of the most constant symptoms of acute mastoiditis is pain over the mastoid. This pain is almost invariably worse at night, and is often described as "boring" in character. The patient may volunteer the statement that during the early stages of the otitis the pain was felt in the ear itself, but now is experienced over a different area, the mastoid region. In some cases, however, the pain is not felt over the mastoid bone, but over the parietal bone and side of the head above the auricle.

Insomnia naturally accompanies pain in mastoid disease. We must remember that mastoid pain is not always present. A few months ago a woman was referred to me because of sudden unilateral deafness. On examination, I found acute purulent otitis media, with a slight amount of discharge in the canal. The patient complained of some discomfort in the ear, but no pain. I treated her for two and a half weeks, performed myringotomy three times, and finally opened the mastoid, which was filled with pus. From first to last she refused to admit that she suffered from pain. The indications for operating in this particular case were: 1. A bulging drum, in spite of repeated myringotomy. 2. No cessation of the discharge after two and a half weeks. 3. Moderate, persistent antral and tip tenderness. 4. Slight sagging of the superior canal wall. In this patient, a culture taken from the mastoid pus at the time of operation showed a pure growth of streptococcus mucosus.

Elevation of temperature is a much more frequent symptom of mastoiditis in infancy and childhood than in adult life. Sys-

* Read by invitation.

temic disturbance is often shown by marked prostration, and by a heavily coated, tremulous tongue. The furred, tremulous tongue should always be looked for, and should be given due weight in judging the patient's condition.

Tenderness on pressure is one of the cardinal signs of mastoid suppuration, and is probably the most constant. It is well to remember that during the first twenty-four to thirty-six hours of an attack of acute purulent otitis media there may often be slight tenderness over the antrum or tip of the mastoid. This tenderness disappears after myringotomy (in uncomplicated cases) only to return a few days later when the mastoid process becomes involved. In the more severe cases of mastoiditis, pressure tenderness may be present from the start. There are four points where tenderness may be elicited: 1. Over the mastoid antrum, namely, just behind the superior attachment of the auricle. 2. At the mastoid tip. 3. Over the posterior part of the mastoid, at the point of emergence of the emissary vein. 4. Over the posterior root of the zygoma, where the so-called zygomatic cells are located.

Sagging of the postero-superior canal wall is another one of the cardinal symptoms of mastoiditis. As a rule, it is not present early in the disease and is usually accompanied by bulging of the drum membrane. In this connection, it is well to remember that we occasionally encounter mastoiditis with an almost normal drum membrane. However, the otoscopic picture will usually show a drum membrane red, angry and bulging, which does not in any way suggest that the middle ear lesion is subsiding.

Anterior displacement of the auricle and edema over the mastoid are present in advanced cases of mastoiditis when perforation of the mastoid cortex has occurred. Furuncle of the canal is, however, a far more frequent cause of retro-auricular edema.

In some cases we find a diffuse swelling beneath the sterno-cleido-mastoid muscle, due to pus perforating through the mastoid tip into the digastric fossa, the so-called Bezold type of mastoiditis. In an ordinary case of acute otitis, the discharge is at first serous, later purulent, and finally, as the inflammatory process subsides, the discharge diminishes in amount and becomes mucoid.

In mastoiditis, instead of the patient's condition improving as the discharge ceases, we find that the cessation of the discharge is accompanied by an increase in the amount of pain, mastoid tenderness and constitutional symptoms, due to obstructed drainage. Or, again, the amount of discharge may be so great that we know it is a physical impossibility for it to come from the tym-

panum alone. The mastoid cells must necessarily be involved. Thus we see in mastoiditis that the character and amount of the discharge are of value in helping us to arrive at a diagnosis.

The bacteriology of the aural discharge is often of considerable diagnostic value. A smear and culture should be made at the time the myringotomy is performed . Wittmanck studied fifty-five cases of acute purulent otitis media. He found ordinary streptococci twenty-four times; streptococcus mucosus, twenty-one times; pneumococci, ten times. Seventy-five per cent. of the mucosus cases developed mastoiditis.

Libmann examined a series of 141 cases. He found streptococcus in eighty-eight cases (pure in seventy-nine), the pneumococcus in eight, *Streptococcus mucosus* in ten, *Staphylococcus aureus* in four, *S. albus* in three, *Bacillus proteus* in one, and *B. pyocyaneus* in two.

It is now quite generally believed that the streptococcus and streptococcus mucosus are more apt to cause acute mastoiditis than the pneumococcus or staphylococcus. In cases where the indications for operation are not perfectly clear, given the streptococcus mucosus, we would feel it our duty to operate at an earlier period than otherwise. Occasionally meningococci are found in the discharge from the ear. This means that the patient is suffering from meningitis, or that he is likely to develop meningitis.

One should remember that the pus from the canal is apt to present a mixed infection, with certain germs predominating, while the pus from the mastoid is much more apt to show a pure culture.

The blood-count cannot be relied on to differentiate acute otitis from acute mastoiditis. It is, however, of considerable value in determining the presence of such complications as meningitis, brain abscess, sinus thrombosis or glandular involvement. McKernon[1] gives his conclusions, based on the study of the blood examinations in 400 aural cases. He believes that these examinations will show two things:

"First the resisting power of the patient, as shown by the number of leukocytes present, which, if over 15,000, shows a good resistance. If daily examinations show a steadily increasing number of white cells, we infer that the patient's resistance is improving, even though the inflammatory process is more pronounced.

"If on the other hand, there is a small number of leukocytes from the first, the patient's resistance to the disease is poor, and

1. McKernon: Buffalo Med. Jour., April, 1913.

during the further progress of the disease, should they steadily decrease, the resistance becomes still poorer, and frequently this is an indication for an urgent operation, or calls for one being done earlier than would otherwise be necessary.

"The second point of value for the clinician is the polynuclear percentage, which shows definitely the amount of absorption taking place in the system as a result of the existing suppurative process. The normal percentage in the adult varies from 55 to 70; in the young child, from 42 to 60. In a suppurative lesion of the mastoid process without complications, the polynuclear percentage ranges from 70 to 80; where adjacent structures are involved, as the blood current in the sinus or vein, it ranges from 80 to 96 per cent. In other words, the higher the polynuclear percentage the greater the absorption and the more urgent the demand for operative procedure, and this is especially true if frequent examinations show a steadily decreasing number of leukocytes.

"If, however, repeated examinations show a decreasing polynuclear percentage with a stationary or slowly decreasing leukocyte count, it is evident that the suppurative process is diminishing and that nature is eliminating the poison from the system.

"*The relation between the leukocytosis and the polynucleosis is the valuable feature.* Increasing leukocytosis, with stationary or falling polynucleosis, indicates better resistance and less absorption, while decreasing leukocytosis and increasing polynucleosis indicate less resistance and a greater absorption."

The preservation of the hearing must always be considered in deciding for or against operation. In certain border-line cases, where the indications for the mastoid operation are not entirely clear, a marked diminution in the patient's hearing, especially in the presence of other symptoms, would induce us to operate at once. On the other hand, we know perfectly well that this type of case very likely may recover without operation, but with the sacrifice of considerable hearing. To sum up: marked diminution of the hearing, in certain border-line cases, is an additional indication for opening the mastoid.

Radiography of the mastoid is a valuable aid in deciding when to operate. It also furnishes information in regard to the anatomy and pathology of the mastoid bone. Dr. Law, radiographer of the Manhattan Eye, Ear and Throat Hospital, has written an excellent paper on this subject,[2] from which I shall quote freely.

2. Law, F. A.: Radiography as an Aid in the Diagnosis of Mastoid Diseases. Read before the New York Academy of Medicine, Section on Laryngology and Rhinology, April, 1913.

The Roentgen ray plate shows: 1. The size and extent of the mastoid cells. 2. The position of the lateral sinus and emissary vein. 3. The presence of pus or granulations in the mastoid. 4. In chronic cases, cholesteatoma. 5. Sometimes, the presence of sclerosis.

In the Roentgen ray plate the normal mastoid shows as a dark area, while the bony partitions between the cells appear as light lines. In the bony structures of the skull, the sinus and emissary vein are seen as dark streaks. Where the lateral sinus crosses the mastoid, the cavity of the sinus is superimposed on the cavities of the cells, and consequently the outline of the sinus is less distinct. In cases where the lateral sinus stands out very clearly in the mastoid bone, we are dealing with either pathological material, namely, pus or granulations in the cells, or with a dense, hard cortex.

In the normal plate the auditory canal appears as a dark spot, about one-quarter of an inch in front of which is seen the articulation of the jaw. When the outline of the auditory canal is rendered indistinct by the presence of pus, the location of the shadow cast by the pinna and the condyle of the jaw aid in determining its site.

Mastoiditis, according to Law, "is shown by the appearance of the cells as compared with the normal side. This may vary from a slight hazy appearance to complete occlusion of the cells. In a mild condition, there is a slight haze over the cells, but the bony partitions are still intact. As the condition progresses, the haziness increases; light spots appear, which indicate collections of pus or spots of granulations. In a severe case, the haziness becomes a dense white blur, with no partitions visible, the lateral sinus standing out clear, and the auditory canal barely showing."

Occasionally a case of furuncle of the external auditory canal is encountered, accompanied by intense edema of the canal, auricle, skin over the mastoid and side of the head. To further complicate matters, we may get a history of a purulent discharge from the canal. We elicit a certain amount of soreness or pain on pressing over the mastoid, and are uncertain in our own mind whether it comes from mastoid disease or from the furuncle. In such cases as this, the Roentgen ray examination is our sheet anchor and can be depended on to clear up our dilemma.

(Lantern slide exhibition of radiographs of normal and pathologic mastoids.)

137 East Fifty-Fourth Street.

WHEN THE RADICAL MASTOID IS IMPERATIVE*

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I wish to thank the Academy for its kind invitation to me to read a paper at this meeting. My subject was chosen because of the serious condition a patient is in when the radical mastoid operation becomes imperative. It is now nearly twenty years since the first radical operation was performed for chronic middle-ear suppuration. During this time great advances have been made in otology. By operation, we are now able to cure many of those old middle-ear suppurations, prevent the development of complications, and also to treat brain abscess due to otitic origin. The modern radical mastoid operation means the complete obliteration of all diseased bone, the throwing into one large cavity the middle ear, aditus, antrum and mastoid cells, thereby giving the patient a chance to recover from a chronic suppuration. The imperative indications are:

1. Caries or necrosis of the petrosa during the course of a chronic middle-ear suppuration. 2. Cholesteatoma. 3. Intracranial complications occurring during chronic suppurative otitis media. 4. Whenever during the course of a chronic tympanic suppuration an acute exacerbation with mastoiditis ccurs . 5. Labyrinthine symptoms.

Caries and necrosis follow the destruction of the mucous membrane. This is true whether the disease at first was a simple acute catarrhal trouble or purulent from the beginning. As a result of this, we have an inflammation of the periosteum with death of the bone; because the nutrient arteries of the bone and the vessels suppplying the periosteum are rapidly obstructed. Depending on the occluded vessels for nourishment, the periosteum or the whole bone becomes necrosed, when it is either ebonized or eroded by the surrounding pus. Any profuse discharge from the meatus which has existed several months must come from the middle ear, and it goes without saying that the drum membrane is either perforated or destroyed. It is very important in what part of the membrane the perforation is. If it exists in the superior and posterior quadrant, it generally means that caries of

* Read by invitation.

the incus has occurred; granulations will form, closing off drainage from the aditus. This causes the pus to find its way into the pneumatic spaces, setting up a periostitis with more or less destruction of bone. If we have along with this cholesteatoma the danger is increased because the pressure from the growing mass may cause the absorption of the roof of the antrum, the bone in the posterior fossa, or the capsule of the semicircular canals, thereby causing an epidural abscess, a diffuse meningitis, a brain abscess, a sinus thrombosis, or an inflammation of the membranous labyrinth. In three cases which I operated on last year all three of the semicircular canals were distinctly outlined, in two of them the facial nerve was also exposed, and one had a fistula of the horizontal canal. All this was brought about by the absorption of the bony covering, caused by pressure from the cholesteatoma. We feel that in all cases of chronic suppuration of the middle ear, when cholesteatoma is positive, a radical operation is necessary to save the patient from a further extension of the disease.

Primary tuberculosis of the ear is more often met with in poorly nourished and bottle-fed babies. It is generally located first in the mastoid cells. The infection probably comes through the blood, or by way of the mucous membrane of the eustachian tubes. It comes on with very little pain and runs such a rapid course that palliative treatment is of little use. In order to save the life of the patient a radical operation must be done. In regard to secondary tubercular infections of the middle ear, this develops most frequently in patients with pulmonary tuberculosis, and seldom with tuberculosis in any other part of the body. It comes on gradually and with little pain, yet the destruction is very great. The wall of the tympanic cavity and antrum resemble macerated bone, the labyrinthine capsule becomes necrosed, and by this means the life of the patient is placed in greater danger. If the patient is not in the advanced stage of tuberculosis, a radical operation should be done as the only chance of stopping the necrosis and preventing development either of a suppuration of the labyrinth or a tubercular meningitis.

Of all the sinuses, the sigmoid is the one most often affected by the purulent suppurations. We may have here a perisinus abscess that will give no symptoms, and then we may have only a small opening over the sinus plate which, not giving good drainage, retains the secretions. This produces an inflammation of the sinus wall, with high temperature. As the inflammation con-

tinues, we have the formation of thrombi which often extend into the bulb of the internal jugular, causing pyemia and death if not operated on in time. We may have either alone, or with a sinus thrombosis, an extradural abscess which is found either on the dura covering the middle or posterior fossa. In the majority of cases it is caused by the direct extension of the inflammation through the bone. The only treatment one can think of in such cases, when it is due to an old chronic ear suppuration, is radical operation and then the opening of the abscess.

Meningitis of otitic origin develops either after the formation of a fistula, or from the inflamed external surface of the dura. It is a well-known fact that the dura is very resistant. If it were not so, we would more often have not only acute meningitis due to infection, but also to traumatism. The clinical picture of meningitis is not always the same, and often very difficult to diagnose from an epidural or brain abscess. As a rule the disease begins with headaches, which are at first remittent, but in time spread over the entire head and become continuous. The patient may have continuous vomiting, sleeplessness and sensitiveness to noises. Lightly tapping the muscles calls forth an active reflex. The most prominent symptom which distinguishes this affection from all the other intracranial complications, especially brain abscess, is the marked excitement which is made evident by screaming, springing from bed, trying to run away, picking at the bedclothes, etc. The course of otitic meningitis, whether due to acute or chronic middle-ear suppuration, runs a very rapid course, especially in children. If fluid from a lumbar puncture is cloudy it points either to a purulent meningitis, a superficial brain abscess or pus in the ventricles. The absence of coagulation fibrin in a clear fluid points to a serous meningitis.

A meningitis may be diagnosed early in its course by means of the biochemical tests of the cerebrospinal fluid as described by Kopetzky. Otitic meningitis runs with few exceptions a fatal course. In circumscribed meningitis, caused by an epidural abscess, a cure is not out of question if the source of infection is removed by operation.

Brain abscess due to otitic origin is very difficult and often impossible to diagnose. The difficulties presented by the differential diagnosis between brain abscess and the different forms of meningitis are apparent from the observation of patients during life, and by the condition of the brain found at postmortem examination. In a number of cases one is

able to make a diagnosis of abscess in the temporal lobe by the aid of certain marked symptoms, such as aphasia, associated with a localized headache in the parietal region, tenderness on percussion, and increased temperature in the affected half of the skull.

The prognosis of brain abscess until within the last few years has been very unfavorable. If the diagnosis is made in time, all the dead bone which was the source of infection is removed and the abscess opened, before the appearance of serious complications, it is often possible to obtain a cure in a number of cases. That facial paralysis is not of more frequent occurrence in chronic otitis is no doubt due to the greater resistance of the bony canal, and to its having a separate blood-supply. When we do have a facial paralysis complicating an old chronic middle-ear suppuration, it is generally caused by necrosis due to cholesteatoma, and should be operated on at once. Of the chronic middle-ear conditions, cholesteatoma no doubt causes most of the labyrinthine infections. Next in frequency is tuberculosis, and then scarlet fever.

Before doing a radical mastoid, when no labyrinthine symptoms appear, a careful functional test should be made, in case the patient after operation should develop any signs of a labyrinthine inflammation. When we have labyrinthine complications, the infection reaches the labyrinth by way of the oval window, round window, fistula of one of the semicircular canals, generally the horizontal, or a fistula of the promontory.

When labyrinthine symptoms do appear, such as nystagmus, vertigo, vomiting, fear of going up or down stairs, with a tendency to fall to the side of the diseased ear, a careful examination should be made with the functional tests in order to decide whether a radical operation should be performed alone, or whether it is necessary to follow the radical operation by a labyrinthine operation.

DISCUSSION

DR. S. J. KOPETZKEY, New York: There seems little to add to the paper by Dr. Sharp except to emphasize his point that he is not giving the indications for the radical operation, but is mentioning the times when the radical operation is imperative. This becomes of great importance when the question of intracranial complications arise.

Another point brought to mind, and one that we cannot repeat too often is, that we do not operate to cure discharge. We now operate to cure a recognized lesion, and to render the remaining portions of the lesion amenable or accessible to treatment.

In children the radical operation should never become imperative, and the chronic suppuration should never be permitted to go so long as to

necessitate a radical operation in the face of impending intracranial complications. In other words the dangers of the radical operation should be avoided by opening the mastoid process and trying to cure the suppuration in the middle-ear cavity before any question is involved, the answer to which is a radical mastoid operation.

Regarding the labyrinth symposium, little need be added to what has been presented this morning so well by Drs. Ballenger, Fletcher and Beck. The summing up of the work presented by Dr. Fletcher, as shown by the drawings by Dr. Ballenger, make the many complicated conditions regarding the labyrinth symposium easier to comprehend. I do want to say that while not attempting to cover everything of the labyrinthine symptomatology, it can be understood when presented in very simple terms, nor are these fine refinements necessary for the practical working out of our case. When the labyrinth is alive and working it does certain things when stimulated artificially. When the labyrinth is dead its reactions fall away, and it makes no difference whether you are testing one canal or another, whether you are using hot or cold water, or whether you are turning your patient or applying electricity. Fundamentally something that you ought to get when using any of these means fails to show itself, and hence you come to the conclusion that the labyrinth is not functioning. Further, you know there is a fast and a slow component to the nystagmus. In doing the Pointing test or any of the reaction movements in the presence of nystagmus they must follow the slow component to be of a vestibular origin. If they are not following this rule, you can rule out the labyrinth as at the bottom of the symptoms. This covers enough for all practical purposes, and I think it important that this statement should be well understood so that an early recognition of the condition may be made. The details of the case may then be worked out by those unfamiliar with them after reference to standard text-books.

When I saw on the program "Symposium on the Labyrinth," I presumed all sides of this question would be presented. In Dr. Beck's classification of five divisions, he has overlooked the non-suppurative conditions of the labyrinth. These very often come for examination and observation, and when subjected to the labyrinthine tests, as a routine measure, they give interesting data. I refer to the Menier symptoms as usually described in our books.

I have examined a number of such cases during the last year, and while I have not enough material for a report it is interesting to note that they show an absence or an abnormality in the reactions in one or the other detail, though not always giving standard reactions, so that one can place the lesion definitely. They do not, however, give the normal reactions of the labyrinth in all its details. In a few of these cases I have advised the labyrinthine operation as indicated so as to hasten that period of compensation and allow such individuals to return to their usual occupations. There is no other method of treatment.

While I am at it—there ought to be a correction made in our literature in reference to this subject. If you comprehend the physiology of the reaction movements through the cortical centers with the involvement of the midbrain, you realize that the failure of the normal nerve impulse to reach their end-organs is due to disarrangement of the impulses by virtue of an abnormal reaction from the vestibular nuclei. Now consider the fact that there are innumerable undemonstrated fiber tracts going down from the midbrain, the cerebellar tract to the stomach, intestinal tract and gall-bladder through the sympathetic system in general, and consider that these fibers carry impulses to these organs. If these

impulses are disarranged by reason of inharmonies or exaggerated impulses from the vestibular center, you can see why such patients have been noted in the literature as having stomach, gastro-intestinal and gall-bladder trouble as the causative agent producing dizziness, vertigo and nystagmus. The fact is it is the other way, and it is the impulse from the vestibular nerve which disarranges the correct and harmonious impulse which should go to these respective organs.

I have not enough cases yet to thoroughly present this view, but I hope at some future meeting of the Academy to drive this home.

Dr. Mark D. Stevenson, Akron, Ohio: It should be remembered that in about 80 per cent. of cerebellar abscesses and 95 per cent. of facial paralyses, the labyrinth is involved. In every case before removing an aural polyp, the labyrinth should be examined. I appreciate fully the magnitude of this whole subject and the impossibility of presenting in any symposium more than a mere outline. Dr. Ballenger's outlines are excellent, and much could be learned from them in a short time. The tests of the labyrinth are simple; it is the proper interpretation of the tests that is difficult and this will require many years for complete solution. I have made a few simple rules for making the labyrinth tests. The direction in which the patient was turned is the same as the side to which the patient points, the same to which the patient falls and the same as the slow component, and opposite to the side of the ear tested, opposite to the side to which the patient thinks he is falling, and opposite to the direction of the nystagmus. Compression or warm water gives ordinarily nystagmus to the same side; aspiration or cold water to the opposite side.

The interpretation of the tests is the interesting and difficult part of labyrinthine work. The leaders in this work often make apparently contradictory assertions, but when these statements are analyzed the difference is more apparent than real. One school states that they do not operate unless the patient is deaf, that is, only in case of purulent labyrinthitis, but they determine deafness by the Stenger test. The other school admits that they operate not only in purulent labyrinthitis, but also in severe cases of diffuse serous labyrinthitis where a little hearing may be retained. Such a patient may hear a shout while the Barany apparatus occludes the other ear, but would be considered deaf by the Stenger test. This school states that there is no sharp line of distinction as to treatment or prognosis between a severe diffuse serous and a purulent labyrinthitis. The former school with a different test claims a different procedure which is essentially the same. This helps to complicate these problems to the student and especially to the beginner.

Dr. G. W. MacKenzie, Philadelphia: It may have been a slip of the tongue when Dr. Ballenger referred to the cortical reflex. The cortical center in the angular gyrus, the Blick Centrum of the German authors has to do only with the quick voluntary movement of the eyes, while the reflex itself takes place through the posterior longitudinal bundle and is responsible for the slow movement only.

I find Dr. Ballenger's figures for after-turning nystagmus entirely too high, due probably to his adoption of the figures from European authorities. For instance, in the case of one-sided labyrinthine destruction he gives the figures thirty-five seconds for after-turning nystagmus to the well side and sixteen seconds to the affected side. I have never found these figures nearly so high. My results show that the average duration of after-turning nystagmus to the well side to be about sixteen seconds and to the affected side about eight seconds. This disparity between his

figures and mine I believe to be due to his faulty observations; that is to say, I make my observations with the patient looking straight ahead, in which position there are no extraneous influences at work. The figures of Baranay and of Ballenger are so high because in making their observations they have the patient look to the side. Normal individuals when looking to the side will show a physiologic nystagmus to that side. Therefore, when we make observations of after-turning nystagmus in the side positions we are obtaining vestibular nystagmus plus the physiologic nystagmus.

Compression and aspiration nystagmus vary in intensity because by compression we are able to obtain a greater degree of positive pressure, for instance, 30 to 40 pounds; whereas, by aspiration we can only get a negative atmospheric pressure of 15 pounds to the square inch. Do not forget, in making the caloric test, in a patient who already has a spontaneous nystagmus to the well side that we may make the examination with the patient's head inclined to the opposite shoulder, in which case cold water will produce a horizontal nystagmus to the same side; in other words, a reverse of the direction of the spontaneous nystagmus.

I wish to declare strongly against the routine method of double irrigation of the two ears with cold water for the purpose of determining the relative caloric reactions of the two ears for the reason, (as has already been pointed out by myself and others) that the reaction is influenced by an intact membrane, by the presence of polyps, cholesteatomata, inflammatory conditions of the middle-ear cavity, stenosis of the canal, etc.

The gentleman just preceding me intimated that the galvanic test was of no practical value in examination of the ears. This is a reiteration of the opinion voiced by Baranay and Neumann at a time when I first took up the subject. I wish to say that I have found the galvanic test of inestimable value in the differential diagnosis of inner ear from nerve conditions; and, too, I have found it of great value in one case in particular, where there was a destructive lesion of the external semi-circular canal. In this case I was able by the galvanic test to determine that though a fair portion of the canal was destroyed, according to the turning test, yet the crista ampularis reacted to the galvanic current. I performed a radical operation and left the labyrinth untouched, and the patient was able to retain good hearing. Had I been guided alone by the turning test in the horizontal position, or by caloric test with the patient's head inclined to the opposite shoulder, I might have come to the conclusion that the vestibular labyrinth was destroyed. The happy result in this case alone is sufficient for me to warrant my making a galvanic test, together with all other known tests in every case of suspected inner ear involvement. I find that these same European authorities who decried the galvanic tests have since adopted my figures and give them out as their own and are again quoted in some American text-books as coming from them. In these figures compiled by myself I find that I made some minor errors, which these same authors followed, showing that they had not done the work independently.

Dr. Beck hits the nail on the head when he suggests that the only possible way to learn the subject of the labyrinth is to do the actual work yourself. No one can learn through books nearly so well as he can from actual experience.

Concerning cerebellar abscess following labyrinthine suppuration, the nystagmus need not always be in one direction. For instance, in case of early cerebellar abscess of the right side, the nystagmus may be to the right side, whereas later it may be to the opposite side for the reason that in the early stage we have more or less irritation about the cerebello-

pontine angle at the root of the vestibular nerve, which would cause the nystagmus to be directed to the same side; whereas later, when actual destruction takes place, the nystagmus would swing to the opposite side. You see, therefore, that given a case with a right-sided labyrinthine destruction with spontaneous nystagmus to the left, should the nystagmus suddenly reverse itself to the right, and especially if the nystagmus is more horizontal and of wide excursions, we have strong presumptive evidence of beginning cerebellar abscess.

In concluding I want to say that the pointing test in the differentiation of labyrinthine destruction from cerebellar disease cannot be taken too seriously for the reason that in one case, as I have pointed out, the nystagmus may be to the same side (early cerebellar abscess) or to the opposite side (late cerebellar abscess).

Dr. J. R. Fletcher, Chicago, (closing discussion): I follow Baranay in this matter. I know perfectly well there has been a long controversy between Baranay and Alexander. Personally I use the caloric tests. I have seen the galvanic used quite extensively, and I have not discovered that it is of much interest clinically. I think it is important for us to know that the symptoms are different between serous and suppurative labyrinthitis. The latter patients sometimes recover all of their hearing. Occasionally, when one could not differentiate between a serous and suppurative labyrinthitis, it was thought imperative to operate, and it was largely through those operations that we learned something about serous labyrinthitis.

As to cerebellar abscess, I think Dr. MacKenzie has put it correctly. The great point is this: that you do have in a great number of cases a moderately high temperature; in cerebellar abscess you have none.

Dr. Joseph Beck, Chicago, (closing discussion): In response to Dr. Kopetzky, will say that I was under the impression that the symposium was principally on the labyrinth so far as it related to suppurative conditions in the middle ear, and that is the reason I left out the other subjects of hemorrhage in the ear, post-traumatic, and all that sort of allied matter.

CONSERVATIVE ENDONASAL SURGERY

W. Perry Reaves, M.D.
GREENSBORO, N. C.

Conservative endonasal operations are those that give the patient the best chance for relief, with the least injury to the physiologic functions of the nose, by correcting or removing abnormal anatomical parts and removing pathologic tissue, with free drainage and ventilation of the sinuses in sinusitis, and are the result of correct diagnoses, the method, the dexterity, the ingenuity and cleverness of the operator and the after-treatment. Like all surgery, the cleaner the cut the quicker the recovery, which lessens the pain during and after the operation. To accomplish this, instruments that are applicable and accessible in nasal surgery are necessary. In my endeavor to do this, I have made or modified a septal wire splint, sinus punch, ethmoid knife and a turbino-ethmoid forceps.

Endonasal surgery is divisible into three heads: 1. To remove or correct abnormal anatomic parts that obstruct its normal physiologic function or produce pressure with pathologic symptoms of pain.

2. To remove pathologic tissue that gives the above named symptoms with or without an excess of mucous or pus.

3. Sinusitis or pan-sinusitis, which is usually associated with the conditions found under divisions 1 and 2. These conditions, if not the exciting cause, likely have prevented a spontaneous cure of an acute sinusitis that developed from a cold, influenza, exanthematous fever, etc. (Maxillary sinusitis from dental causes excepted.)

Under these three heads I will briefly outline the usage and advantages of these instruments as I see them, and hope in return to have your criticism of their shortcomings and dangers. Under the first division comes the submucous resection of the septum to correct an abnormal anatomic condition, to re-establish the physiologic function of the nose, to relieve pain from pressure, and to aid in the cure of pathologic conditions by better ventilation, has passed beyond the speculative stage. The indication for the operation and the technic of the different operators vary but little in essentials except in the after-care. We have been taught

to pack the nose to prevent hemorrhage or a hematoma which may become infected while being absorbed—if not absorbed it leaves a thickened septum. This packing makes the patient an uncomfortable mouth breather, often with nausea from postnasal secretions plus headache, neuralgia, sinusitis and earache. The least that one can possibly get off with is the congestion of the nose and sinuses, which prolong the recovery of the operation. To escape these conditions Ostrom and others do the submucous resection without packing.

Brunings has made two wire septal splints that extend half an inch beyond the tip of the nose, which makes it impossible to wipe the secretions from the upper lip without hitting the wire, thus keeping up continual irritation. This objectionable feature I have eliminated by an elongated septal wire splint compressible from side to side (two sizes, right and left), which facilitates entering the nares and placing them. When the right and left, or left and right splints are placed in the desired position they are locked in front of the septum, then pulled high up on the septum near the tip of the nose and anchored with a small piece of adhesive plaster (6 x 15 mm.) to the tip of the nose. This splint gives the advantage of a packed nose without any packing. The mucous membrane is held together, prevents bleeding and hematoma, the nares are open, and the patient can breathe through his nose, can cleanse it and use his handkerchief. The recovery is quicker and is without the punishment of the packing.

Experience has taught that contact with the mucous membrane is all that is necessary, therefore pressure by the splint should be very little. Pressure of the splint enough to hold the weight of a small blotter is sufficient. I further protect the membrane from injury by the wire by placing a very thin piece of Simpson's nasal tampon, not thicker than heavy writing-paper, between the splint and the mucous membrane, which is ideal except its tendency to catch mucus. To overcome this I have used the thin finger cot (without the reinforced end) over splint and tampon, and now hope to have made a rubber sleeve to slip over the wire splint with the septal side about twice as thick as writing-paper. The wire splint must always be smaller than the cartilage and bone removed, otherwise the splint will not keep the mucous membrane coapted if resting on any cartilage or bone; besides, if the splint is spread it may come in contact with the middle turbinate and be a source of pain.

Under the second division comes the pathologic conditions of the nose, which should receive the proper surgical care before opening the sinuses.

The vicious circle described by Ballenger as the "key" to the sinus diseases is to me the lock that closes their door, and has its combinations, like the lock to the outer door of a safe, that must be opened before the key to the deposit boxes is accessible. The first turn in this lock is to remove the anterior tip or half of the middle turbinate; the next turn, part or all of the anterior ethmoidal cells, and in some cases part of the uncinate process and

Figure 1.—Frontal sinus punch.

bulla ethmoidalis, then we have access to the key-holes of the maxillary and frontal sinuses, which must become open doors for drainage and ventilation to effect a cure. The key best suited to open these doors must be small enough to get into the nose, curved enough to pass through the keyhole, which is at right angles to the anterior nares, and cuts in every direction in order to break down the door at the most desirable place for drainage and ventilation.

This I believe I have accomplished in this instrument, which has been described in *Jour. A. M. A.*, Dec. 16, 1911, entitled "A New Sinus Punch." This improved model has the cutting

edge at right angle to that of a straight biting forceps, meets the requirements to enlarge the natural opening; (1) small enough to get into the nose; (2) curved to a right angle, with a cone tip which facilitates the entrance into the antrum; (3) cuts in every direction, like the Fletcher antrum punch; (4) strong enough to remove the antral wall and part of the uncinate process, bulla ethmoidalis and encroaching lower anterior ethmoid cells, which when diseased, if left, are a source of reinfection of the antrum, especially when the opening has been made under the inferior turbinate.

Removing this source of reinfection is the secret, I believe, of better results in my hands than the older method of opening the maxillary sinus under the inferior turbinate. In most cases enlarging the maxillary opening back to the posterior wall of the sinus and junction of the inferior turbinate will give ample drainage and ventilation to effect a cure. The granulations can be nibbled off from time to time until the inflammatory condition has subsided. Should the antrum be low and the inferior turbinate high, the opening can be enlarged downward, cutting through the inferior turbinate and continuing the opening under the turbinate. This has the decided advantage of leaving the anterior half of the inferior turbinate which is so essential, especially when the middle turbinate and ethmoid cells have been removed. This anterior half of the inferior turbinate maintains the relative space of the anterior two-fifths of the nares and in inspiration there is a tendency to form a vacuum in the antrum when the opening is well back, which is conducive to circulation of air in the antrum during inspiration and expiration.

To Dr. A. M. Anderson of New York I am indebted for the suggestion to use the small punch to enlarge the opening of the frontal sinus, and I am glad of this opportunity to give him credit for the work he has done on a similar instrument that cuts on the pull at the time the punch was described in *Jour. A. M. A.*

In chronic frontal sinusitis the anterior ethmoid cells that form part of the walls of the frontal duct often, by a necrotic process, enlarge the duct enough to receive the cone tip (3½ to 4 mm.) of the small punch, after the anterior tip of the middle turbinate and ethmoid cells have been removed. Then pass the cone tip into the frontal sinus and nibble away the granulation tissue, the cells encroaching on the frontal duct, and the high ethmoid cells, which often enlarges the opening to 6 mm. in

diameter, and the punch slips into the antrum. In no case should we attempt to enter the sinus with the punch until the location and the size of the duct is ascertained by probing. In those cases found to be too small to enter with the cone tip of the punch, the duct should be enlarged forward and laterally by Goode's rasps and the operation completed with the punch.

By careful study of the formation of the posterior wall of the frontal sinus, which continues backward as the roof of the ethmoid cells, you will see that the danger of buttonholing this plate of bone with the punch and exposing the dura mater is very remote, and the high ethmoid cells surrounding the duct and blocking drainage can be removed.

In pan-sinusitis a complete ethmoidectomy should be done before enlarging the opening of the maxillary and frontal sinuses. This is done in many ways by different operators, with forceps, scissors, knives, snares, etc. These piecemeal operations have the disadvantage of a bloody field, obscuring the operator's vision; every little bite gives the patient about as much discomfort as a big bite, prolongs the operation, taxes the patient's nervous system, and leaves a ragged field with a slower recovery. In ethmoid operations we should always remember that the cleaner the cut, the less the pain and the quicker the recovery. Ballenger's "ethmoid-turbinate" knife, in the hands of one who has developed the technic and has the boldness to use it, meets these surgical requirements; to those who have not developed the technic and have not acquired the boldness, as the operation has to be done more by the sense of touch than by sight, remove the ethmoid with a sharp instrument that cuts loose the ethmoid body from its roof, which is the floor of the skull. The operator, if I may judge from my own experience, feels the nervous shock more than the patient.

To overcome this fear, if not a danger of cutting through the roof of the ethmoid into the cranium, I have had made a right-angle ethmoid knife (R. and L.) mounted on a curved shank that slides along the roof of the nose as the cut is made forward; this shank is received into the curved barrel as the knife is pulled forward. The curved barrel is its nasal or distal end, and has an 8 mm. hook that turns up, down, right and left to engage at the anterior junction of the middle turbinate and the ethmoid, or nearer the roof of the nose, by removing just above this point the anterior end of the vertical plate of the ethmoid, with straight

biting forceps. The curved shank facilitates the passing of the right-angle blade under the middle turbinate to its posterior attachment; the hook may be left unlocked, if the nose is close, and rotated to the desired position by a probe or forceps after the instrument has been introduced into the nose; then the hook is anchored at the anterior end of the ethmoid and the knife at the posterior end. The curved shank between the hook and knife is high up in the nose, the shank of the knife slips into the barrel exactly like the wire in a snare, and the handle of the instrument works exactly like the handle of a snare; thus the hook grasps the ethmoid, as it were, and holds it as the knife severs it from its posterior and superior attachments.

This requires very little force and the patient does not have the sensation of something being pulled out. The curved shank

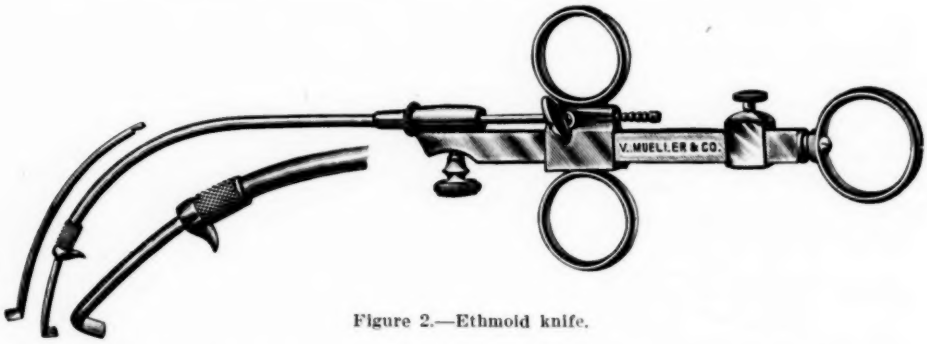

Figure 2.—Ethmoid knife.

carrying the knife at right angles is the excuse for presenting this instrument. The knife cannot cut higher than the shank, the shank cannot go higher than the roof of the nose, and the roof of the ethmoid is a little higher than the roof of the nose, which eliminates the danger of cutting through the roof of the ethmoid. The ethmoid may be severed high or low by moving the handle down or up as the knife is pulled forward (The edge of the knife points 15° above the shank; gentle pressure on the handle toward the patient's larynx as the knife begins to cut, will make it follow dotted lines to roof of the nose.) The ethmoidectomy is completed by cutting the cells loose from the orbital plate with forceps, scissors, knife, with or without the snare.

For those cases in which the septum is deviated or the middle turbinate or ethmoid obstructs the nose so that the shank cannot

be passed to the roof of the nose, I have had made small alligator forceps, right and left, with the cutting part bent down 35° from the shank which, when introduced into the nose, is parallel to its roof; with these punches an ethmoidectomy is just reversed — beginning at the anterior ethmoid cells, cutting the vertical plate loose from the cranial plate from before backwards, then completing the operation as before. The sphenoid sinus is now accessible and can be opened with any of the straight sphenoid punches.

The last chapter in nasal surgery has not been written, nor do I contend that these instruments have solved the obstacles in nasal surgery, but I do believe that the mechanical principles of the nasal splints meet the requirements of those who pack the nose and those who do not pack the nose, combining the good points of each and eliminating the objectionable features of both.

Figure 3.—Alligator forceps.

The construction of the sinus punches is such as to meet the surgical requirements to drain and ventilate the sinuses, minimizing the danger, pain and shock to the patient, enabling the operator to leave the inferior turbinate, in pan-sinusitis being the only tissue that can be left on the operated side that is not pathologic. In maxillary sinusitis, either acute or chronic, the natural opening can quickly be enlarged under the middle turbinate, especially after its anterior tip has been removed, with the small punch, and with the large punch under the inferior turbinate, when the vicious circle is not pathologic.

The alligator forceps are very handy in removing part or all of the middle turbinate, and severing the vertical plate of the ethmoid from its roof in doing an ethmoidectomy.

DICSUSSION ON SYMPOSIUM

DR. J. M. HOGSHEAD, Chattanooga: I took Dr. Reaves up to the office yesterday and had him to do one of these operations. As some of the doctors said who saw it, they felt repaid for the trip here to see Dr. Reaves do this work. You know when we hear of a man along this line coming here we usually look up the meanest case and hand it over to him, and that was the case with Dr. Reaves. The patient was a colored man, suffering with a chronic frontal, ethmoidal and antrum infection for some time. The whole area there was in about as filthy a condition as you could possibly imagine. After the patient was thoroughly cocainized, I do not think I exaggerate it when I say it took him from twelve to fifteen minutes to do the three operations. He opened up the maxillary sinus in about four minutes through the natural opening. That gave good drainage, but after we had examined the patient carefully we suggested that he also open up under the inferior turbinate, and got a great deal more pus. I may differ with the doctor, but I think the nearer the floor the more drainage you get on account of the dependent position. The frontal sinus took him a little longer to get into, but there is no doubt he got into it, for we had a Roentgen-ray machine so we could see. I saw the patient about thirty minutes ago and he was feeling much better. The punch I think is one of the best on the market to-day. The knife is much after the order of the Ballenger knife, with the exception of the pin which holds it more stationary.

DR. H. H. MARTIN, Savannah, Ga.: I saw Dr. Reaves display these instruments at Greensboro last April and was very much impressed with them at the time, and had the pleasure yesterday of seeing him operate. I was also much impressed with the rapidity, ease, and certainty with which he accomplished his object. It seems that in this case the middle turbinate had been operated on before, the anterior half being gone, and almost quicker than I can tell you, Dr. Reaves had gone in and brought out a large mass of half or two-thirds of the middle turbinate and the whole superior turbinate with the ethmoid cells. Then in a moment, his cutting forceps was up in the frontal sinus. I think it was about the cleverest piece of work I ever saw, and I am glad to get up and endorse what he has done.

DR. W. L. BALLENGER, Chicago: I owe an apology to Dr. Reaves and I am willing to make it in public. Dr. Reaves loaned me his instrument, that is, this modification of my instrument, when I was at Greensboro, last February and I took it home with me but I neglected to take it to my office. He wrote me a letter and finally sent a telegram, to know if I was ever going to send it back to him. I have no doubt the doctor thought there was something wrong in my feelings, or you might say in my absent-mindedness in taking it to my office where I could have used it. I had many opportunities of trying it, but did not for the reason above stated, and I want to apologize to the doctor for my seeming discourtesy.

His idea of the fixation of this instrument of mine is a good one. One thing I do now, which I never wrote about, is the fixation of the instrument by grasping it where it enters the nose. In other words, when I use this knife, I introduce the instrument into the nose and immediately my finger goes under the nose of the patient, the thumb grasps it above, and with this fulcrum I tilt the knife forward and make the cuts. It strikes me that this is a little easier and simpler than to adjust a fixation point inside the nose. If I were going to apply a fixation point on the instrument, I would do it with a cross-bar adjusted outside the nose against the septum, as I do with my finger and thumb.

I am glad indeed to hear more of Dr. Reaves' operation. I am glad it does all that is claimed for it. My instrument is really not a cutting instrument, but it fractures the bone in advance of the blade with a slight wiggly motion. And if you come to a dense spicule of bone you have to lower the instrument and come down over it. In the many years I have used this instrument, I have only broken one.

I am interested in the tack forceps, of the Fletcher model. What he says about it is that it will not denude all the surface of mucous membrane as the rasp will do; and in that sense it is much better than the rasp instrument.

I only rise to express my interest in Reaves' procedure and any improvement he may accomplish in the ethmoid operation.

In removing part of the inferior turbinate body in antrum disease, as Dr. Reaves has suggested, I suggest a better thing would be to remove the wall above the turbinate and then remove the wall below it, leaving the inferior turbinate intact, for this will establish good drainage and preserve the important functions of this inferior turbinate body.

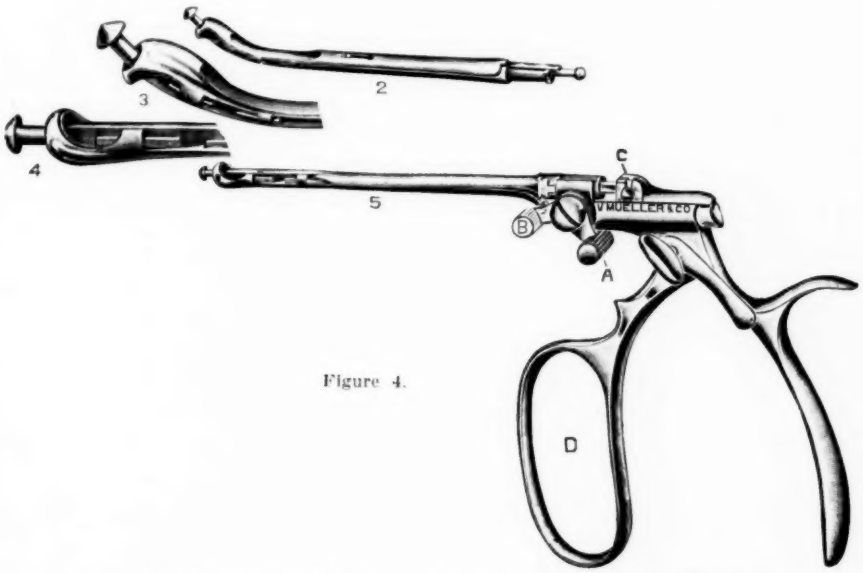

Figure 4.

Dr. J. R. Fletcher, Chicago: I have only a word or two to say about this instrument. I got it out a few years ago and called it "mushroom-shaped." When that was published in the *Laryngoscope* and abroad, I then predicted that this particular kind of cutting instrument would have wide use, because it cuts in any direction without changing the position of the hand. I rarely have occasion to do a Killian now. I also go into the ethmoid cells and cut up with the straight punch. One of the hardest things to remove is the anterior plate of the sphenoid. After that instrument is introduced into the natural ostium of the sphenoid, you can cut out the anterior wall in one minute with your eyes shut. The instrument cuts down to the floor, then you pass along the floor to the septum, up the septum to the summit, and then across, and you have your piece out. I want to commend Dr. Reaves on his ingenuity in widening the field of usefulness for that instrument.

DR. W. P. REAVES, Greensboro, (closing discussion): Dr. Ballenger spoke of catching a hard spicule of bone with the ethmoid knife. The first time I used the instrument to remove the ethmoid, the force to cut loose the ethmoid was so little that I thought the instrument had slipped.

In opening the maxillary sinus in the middle fossa after the cone tip of the punch enters the maxillary or punctures it, it takes a minute or less to enlarge the opening as broad and twice as long as your little finger-nail. Often I have to watch myself that I do not take out too much.

In others where there is necrosis and polypi to block drainage, I use the larger punch and extend the opening down through turbinate and wall, continuing the opening under the inferior turbinate, leaving the anterior half of the inferior turbinate intact.

THE ENDONASAL ROUTE OF ATTACK IN HYPOPHYSEAL TUMOR CASES

W. E. Sauer, M.D.
ST. LOUIS

As late as 1882 Hyrtl stated that the sphenoid cavities were entirely beyond the reach of hand or instrument. To-day, the modern rhinologist not only deals with these sinuses as a part of his regular routine, but has employed these cavities as a route to enter the cranial cavity. After the experimental researches and clinical observations had proven that the disorders of the hypophysis were amenable to surgical intervention, the rhinologist was not long in proving that these diseases were not only within his province, but has been able to show a lower mortality rate than others working along this line.

The hypophysis has been reached by two different routes; (*a*) the intracranial, and (*b*) the extracranial or transphenoidal. The intracranial route was first suggested by Canton and Paul, and later employed by Horsley. McArthur attempted to attack the hypophysis through the anterior cranial fossa in 1908, but failed. Bogoisolensky performed the first successful operation by this route in 1912. Schloffer, however, performed the first successful operation in 1907, employing the transphenoidal route. He found it necessary to remove practically the entire nasal interior, as well as to temporarily resect the external nose. This operation was later modified by Koenig, Kanavel and Halsted, but to Hirsch of Vienna belongs the credit of developing the endonasal operation. He conceived the idea that the sella turcica could be opened through the nose without the preliminary operation of severing the external nose from its attachment, and turning it to one side as was done by Schloffer. The real point in Schloffer's operation was the opening of the sella turcica through the sphenoid. To accomplish this he and others found it necessary, in order to have sufficient room to work, to first resect and push aside the external nose. The real difficulty, as stated by both Schloffer and Von Eiselberg, was to keep their bearings after they entered the ethmoid, it being extremely difficult for them to tell if they were still within the ethmoid or had reached the sphenoid. Von Eiselberg attempted to take his measurements from the Roentgen rays. In one instance

at least, it was necessary to call on the anatomist Tandler to assist him in finding the sphenoid cavity.

Hirsch carried on some experiments on the cadaver, and attempted to open the sella without disturbing the nasal structures other than removing the middle turbinate. He succeeded in making an opening in the floor of the sella 1 cm. by 5 mm. wide without injuring any of the surrounding structures. These experiments were later controlled by Erdheim of the Pathologic Institute of Vienna. Hirsch had also observed, in all of his work on the sphenoid sinuses on the living, how much of the upper wall of the sinus could be seen and how relatively easy it would be, especially when there was a large sinus, to open the wall and, if necessary, to remove part of it. His studies of a large number of Roentgen rays of the skull still further confirmed his views.

Hirsch developed two methods of attack through the nose: 1. The ethmoidal route. This consists of the removal of the middle turbinate with the exenteration of the ethmoid labyrinth on the same side, giving a free exposure of the anterior wall of the sphenoid. The anterior wall is then removed as far as possible and the upper wall or floor of the sella turcica is opened with a chisel, the opening being enlarged with a suitable forceps. 2. The septal route, which consists of a complete submucous resection in the usual way. In addition, the mucous membrane covering the anterior wall of the sphenoid is pushed to each side until the openings of the sinuses are visible. The entire bony septum having been removed, the openings of the sphenoid are enlarged and the partition between the two cavities is then removed. Free access is thus obtained to the upper wall of the sphenoid, which is opened, and the opening enlarged as before.

In this operation, the work is done entirely between the two mucous membranes of the septum. If the middle turbinate must be removed it should be done several weeks before; the advantage claimed for this route is that all manipulations are carried on within a sterile cavity without entering the cavity of the nose. However, this is not always possible because the mucous membrane is not so easily deflected from the anterior walls of the sphenoid, and as the mucous membrane is rather thin at this point, it is easily torn and the cavity of the nose is entered, at least this occurred in my case.

About the same time that Hirsch was doing his work, West of Baltimore brought forward a method which he worked out on the cadaver. His method consists of a partial removal of both inferior

and middle turbinates. Enough of the turbinate is removed to give a good view of the anterior wall of the sphenoid. Without elevating the mucous membrane of the septum, he makes a vertical incision through the cartilaginous septum, and then, by means of a chisel, makes a cut beginning at the upper end of the first incision, extending to the upper part of the posterior end of the septum. A second is made from one-half to three-fourths of an inch below and parallel to the upper cut. The bone is then removed, giving free access to the sphenoid, and a large space to work in, and the anterior wall of the sphenoid is then removed with a chisel. The septum of the sphenoid is now removed and the sella opened as in the Hirsch operation. Cushing makes an incision under the lip, and does a complete resection of the septum through this incision. He claims that in starting under the lip there is about twice as much more room than that secured by the Hirsch method. Cushing calls attention to the difficulty in avoiding a tear in the mucous membrane in elevating it from the cartilagenous septum, and also points out the possibility of entering the ethmoid and mistaking it for the sphenoid. In one case the cribriform plate was opened, owing to the fact that the angle of attack was directed too high. This error would not be likely to occur with a patient under cocain anesthesia if the Hirsch or West technic were followed.

The chief objection to the intranasal route has been the danger of infection. It has been argued that the nose is not a sterile cavity, and that it is impossible to make it sterile, the danger being a resulting meningitis. This, however, has not been borne out by experience. Hirsch has reported twenty-six cases of hypophyseal tumor, which he has operated on with only three deaths. One death was due to a pneumonia and another to hemorrhage occurring into the third ventricle, and in the third, a meningitis. In this case the patient was a dement, who removed the packing himself. The results of Hirsch's operations are better than any series of operations reported by other writers. Cushing had four deaths in twenty-nine cases. Von Eiselberg had four deaths out of fourteen cases. In thirty-two operations according to Kanavel's method, six deaths occurred.

Spiess and Holmngren each report a case operated on by the Hirsch method with good results. Adding my own case to this makes a total of twenty-nine cases, with a mortality of 10.3 per cent. as compared to Cushing's 13.7 per cent. Furthermore, Hirsch operated on one of his cases six times, and another four

times. These secondary operations should be considered in making up the percentage, as these operations expose the patient to the same danger as the primary operations; when those are added, it brings the mortality rate down to 8.1 per cent. These figures would prove that the danger of infection is more apparent than real. Schloffer has further shown that the hypophysis differs from other portions of the brain in that while all the other portions of the brain are covered by the pia, arachnoid and dura, the sellar portion of the hypophysis is covered only by the dura. The subarachnoid space is not opened when only the sellar portion of the tumor is removed, thereby greatly lessening the danger of infection.

Cushing states that, as a matter of fact, the risk of inducing an infectious meningitis is comparatively slight when the turbinates are not removed and the mucous membrane is not lacerated. Even the existent risk is greatly lessened by the application of Crow's discovery, that hexamethylenamin finds its way into the cerebrospinal spaces. This drug is given in doses up to 60 grains in twenty-four hours, by mouth, on the day preceding and for some days after the operation. Von Eiselberg reports two deaths from an infectious meningitis following his modification of the Schloffer operation. He attributes this infection to an existing acute rhinitis which had been overlooked or underestimated by him. One case died within thirty hours and the other four days after the operation.

In looking over the literature, I found reports of thirty cases operated on by the endonasal route; twenty-six of these were performed by Hirsch of Vienna, one by Spiess, one by Holmngren, one by Pierce, and one by Morshik. In summing up his results Hirsch states that three deaths occurred, one from pneumonia, one from a hemorrhage into the third ventricle and one from meningitis; in three cases there was no improvement following the operation; in two there was a marked defect in vision of long standing, and the other was an old case of acromegaly. He concluded that in these cases the principal parts of the tumor had grown upward, then either the small part removed had no influence on the symptoms, or else the optic nerves had been destroyed. In five cases the relief obtained was only of short duration — two to six months; in sixteen cases the results had been good, and the improvement obtained has been maintained. In this group are a number of cases in which there has been a marked improvement in vision as well as improvement in the general symptoms.

Figure 1.

In one case two years have elapsed since the operation with no recurrence of the symptoms.

Pierce of Chicago reports a case of increasing blindness, diplopia and headache, in which a growth in the sphenoid sinuses was suspected. The middle turbinate was removed and the ethmoid cells were opened; the anterior wall of the sphenoid was then removed and a slight amount of mucopus was evacuated. The lining membrane of the cavity was pale and smooth. The striking feature was the small anteroposterior diameter of the cavity. When touched with a probe it conveyed a sensation of bogginess; marked improvement followed this decompression. The case was later operated on by Dr. Halsted, doing a modified Schloffer.

Spiess reports a case in a patient aged 28, in which the diagnosis had been confirmed by the Roentgen ray. He followed the technic of Hirsch and found, instead of the posterior wall of the sphenoid cavity, a tumor about the size of a hazlenut, which proved to be a cyst. In attempting to remove this cyst it was ruptured; the contents were removed and as much of the wall as possible was curetted away. The patient ran a temperature for a time, but made a good recovery; vision was restored, with marked improvement in the general symptoms.

Holmngren reports a case of a man aged 40, who complained of headache with marked impairment of vision. He had a bitemporal hemianopsia and contracted visual field, and Roentgen ray revealed a destruction of the bone beneath the sella turcica. Both middle turbinates were removed, a submucous resection of the septum was done, and the anterior wall of the sphenoid was removed. The tumor had destroyed a part of the posterior wall of the sphenoid; no attempt was made to remove the tumor, and marked improvement in vision and general symptoms followed.

The case operated on by Morshik was a patient of Von Eiselberg's in which the latter had done a temporary resection of the nose; he opened the ethmoid and a quantity of mucopus was found. A pulsating tumor was seen in the region of the sphenoid, but owing to the unexpected presence of pus in the ethmoid, Von Eiselberg decided not to attack the tumor; the wound was packed with gauze, the nose was stitched back in place and the gauze tampon removed on the seventh day. Dr. Morshik was called in to see the case; he found large quantities of pus in the epipharynx. Four weeks later the patient developed an acute angina which necessitated the postponement of the operation. The mucopurulent discharge finally ceased, and two months after the first

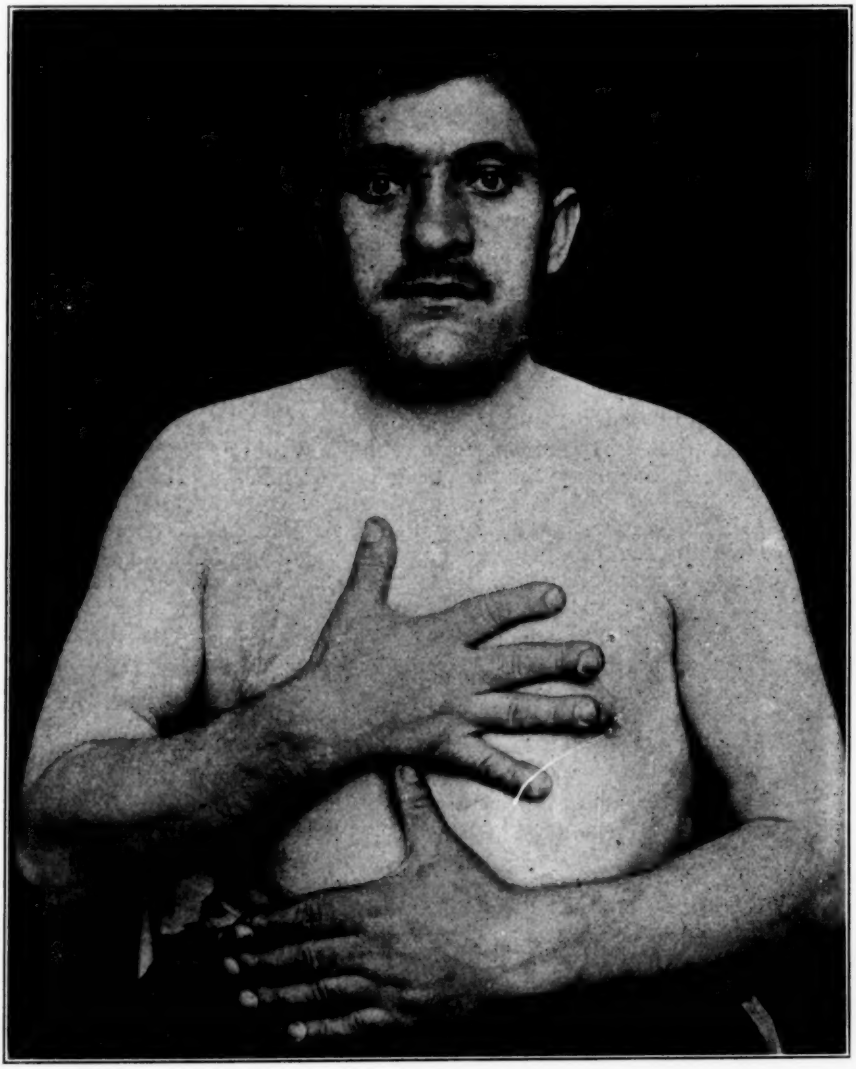

Figure 2.

operation Morshik attempted the endonasal removal of the tumor. The patient was given a morphin-scopalamin injection one hour before the operation, and the mucous membrane infiltrated with a 1 per cent. novocain solution. This tumor was found to be covered with granulations which had to be removed, and the opening in the sphenoid was enlarged. On attempting to remove the tumor, it fell to pieces on the floor of the nose. A free hemorrhage followed; this was controlled by packing with gauze, the gauze was removed after a few months, and a probe introduced, which passed into the cranium for quite a distance without any resistance; the gauze was again gently packed into the wound, and removed one hour later. The tumor proved to be a sarcoma. The evening after the operation the patient had a high temperature with headache. Patient died in forty-eight hours of meningitis.

In conclusion I wish to report the following case referred by Dr. Behrens, to whom I am also indebted for the history and the physical findings:

Case 1.—S. D., aged 32, white, former coal miner, now saloon keeper, Lithuanian (Russian Poland). Patient large, thick set. Quit work as miner because of weakness and cardiac distress. Sent to me in October, 1911, because of palpitation and oppression over heart, causing anxiety and fear, weak generally, growing weaker; has gastro-intestinal disturbances without undue provocation.

Family History.—Father died at 67, cause unknown; was of normal proportions. Mother, aged 75, living and well, also normal physique; brother living and well, aged 42, perhaps large, over average height and weight; sister, aged 52, dead, cause unknown. Family were all large, but not ill-proportioned; knows of no nervous, cancerous, tuberculous or kidney disease in family.

Previous History.—General health splendid until age of 17. He has had the milder exanthemata of childhood, but no scarlet fever, diphtheria, rheumatism, St. Vitus dance, typhoid fever, pneumonia or malaria. He denies venereal disease or sexual overindulgences, and has been moderate in habits as to tobacco and drink.

Personal History.—At the age of 17 began to have slight headaches, never severe, but at times periodical and constant, frontal in character and especially in early morning. Some ten years ago the symptoms increased, plus visual disturbances, most prominent in left eye, then gradually the right eye began to show similar disturbances, and cannot now see as well with left eye; suffers from cardiac excitability.

Examination.—No deafness, no ear discharge; odd feelings in head; no cough, no dyspnea, no edema, perspires easily; good appetite, some dull pains in stomach and around heart, no nausea

or vomiting, eructates sour material at times, bowels regular; urinates regularly, no gonorrhea or syphilis; no convulsions, numbness or peripheral pains, normal sexual power and desires; abdomen negative, no enlargements palpable of spleen or liver; penis has no scars, good development, likewise testes of normal consistency. Normal knee-jerk, no Babinsky; no clonus, no edema

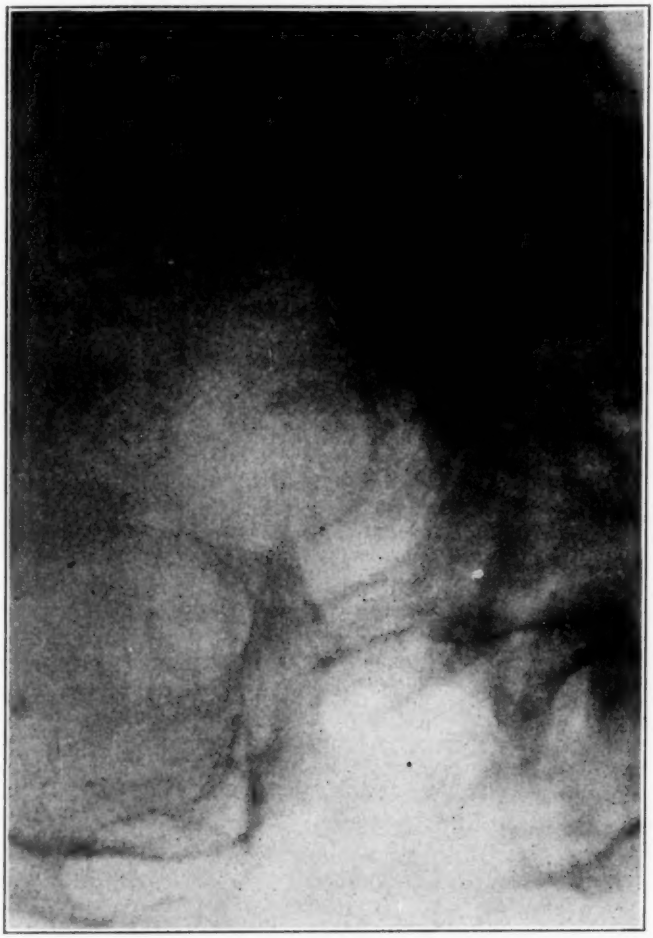

Figure 3.

of legs or ankles; some veins enlarged. Both feet large, large toes quite abnormally thick, others above normal; bones of legs and thighs not irregular or equally or proportionately enlarged. Spade-like hands, large fingers, short, thick thumb 9 cm., mid-finger 9 cm. Teeth show marked separation owing to enlargement of

lower jaw. Tongue is also large. Pupils not dilated, respond to light, disks unusually bright and shining, optic atrophy slight, no vessel engorgement, not tortuous. Vision good; right eye 15/12, left 15/200. During year of observation, very little difference in any condition, mental or physical, was noted, with the exception of marked decrease of vision in left eye. No discharge of nose. Over skin of thorax, abdomen and back are numerous nodules, firm, fibrous-like in feel, not tender, and are movable. Roentgen ray shows a very large sella turcica as well as a large sphenoid cavity.

The indication for operation was the increasing loss of vision in the left eye and the cardiac distress. The patient was sent to the Deaconess Hospital on November 28, and the following day, after the usual preparation for a submucous resection of the septum, he was sent to the operating-room. The septum and the region of the anterior walls of the sphenoid were carefully cocainized with a 20 per cent. solution of cocain. In addition, a ½ per cent. solution of cocain was injected on each side of the septum near its posterior end. The septum was deviated to the left anteriorly, and the right posteriorly. The middle turbinate was removed on the left side, after which a submucous resection was done in the usual way. The mucous membrane on the anterior wall of the sphenoid was pushed to the side, until the openings of the sphenoid were reached. These openings were enlarged and the partition between the two sphenoid cavities was then removed. The upper wall of the sphenoid was found to be much lower than usual; it appeared to be bulging down into the cavity. The upper wall of the sphenoid cavity was then opened by means of a chisel. This opening was immediately enlarged by means of a punch forceps. The bone was not as thin as was expected, but there was no difficulty in removing it. An opening about 1 x ¾ cm. was made, and the dura incised by means of a sickle-shaped knife. This incision was very painful, but succeeded in making a crucial incision. The mucous membrane covering the anterior wall of the sphenoid was torn to such an extent that the nose was packed in the usual way, and not between the mucous membrane as recommended by Hirsch. The pack was removed at the end of twenty-four hours, there was no unusual bleeding or any other unusual symptoms following the operation. The patient noticed a marked difference in the heart's action and stated that he felt much lighter; he particularly noticed that the foul odor he had previously noticed had disappeared. The patient left the hospital ten days later.

An ocular examination by Dr. Parker showed the following: Conjunctiva, cornea, anterior chamber and iris, normal. Reaction to light better in right than left; accommodation better in right than in left; visual acuity in right normal, left 17/120; could not be improved. Ophthalmoscopic examination showed right eye very slightly beginning atrophy; left, fundus on the temporal side looked clouded and markedly thinned, and in places disappearing entirely. Nasal half vessels much more easily defined. Color

field much contracted, especially temporal side of left eye, also interlacing.

Dec. 10, 1912. Vision right eye normal, while left was much improved; vision 17/60. Jan. 2, 1913; patient feeling and looking much brighter; vision right eye normal, left 17/50. Feb. 1, 1913, right eye normal, left still improving; vision 17/40.

Eleven months have elapsed since the operation. The improvement in the vision in the left eye still remains at 17/40. The patient has been working as a laborer, and has experienced no trouble with his heart, whereas before the operation it was a great effort for him to walk more than a block at a time. No accurate measurements of his hands and feet were taken, but the patient insists that his hands are smaller and that he now wears a smaller shoe. He can now bring the upper and lower teeth

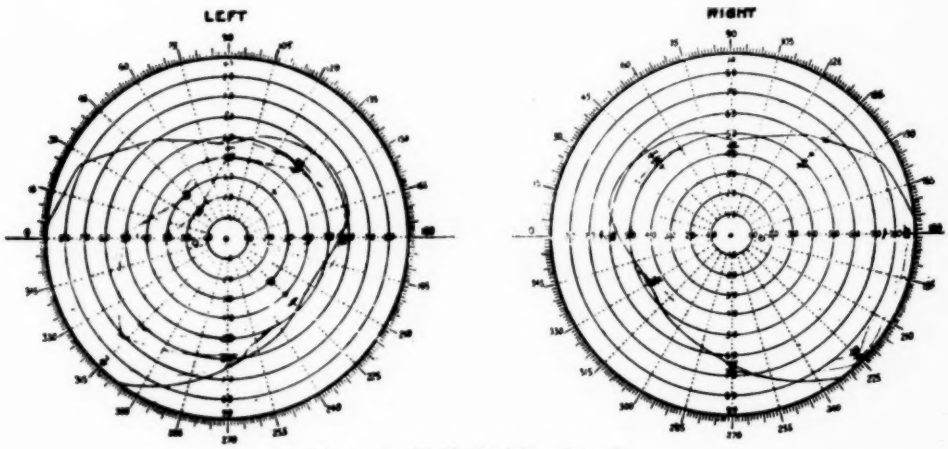

Figure 4.—Field of vision, Case 1.

together, whereas before the operation the lower teeth protruded almost a half inch. Just how long this improvement will hold it is impossible to say; should there be a return of the symptoms, will attempt to remove a part of the tumor.

DISCUSSION

Dr. J. C. Beck, Chicago: I had the pleasure of seeing Dr. Sauer's patient a few weeks after the operation, and the case was certainly relieved then so far as headaches and vision were concerned. This subject of hypophyseal trouble must be interesting to all. Here it is where the four specialties meet: the oculist, the rhinologist, the neurologist and the general surgeon. Of course, we are trying to deprive the latter of his thunder by going through the nose. A few months ago we had a symposium in the Chicago Ophthalmological Society in which I had to present the operative side, and in order to learn more than I could read about it, and not

having had any personal experience in operating on the living for hypophyseal tumor, I operated on nine cadavers. I will take the liberty of passing a photograph of each operation and you can see the various technics as they have been performed. I also experimented, on account of finding certain difficulties in the Hirsch operation, namely, that portion of the septum (vomer) which is close to the sphenoid, is very wide. You will find that the septum flares out and it is difficult to remove the vomer in that part. I experimented with an operation which would be nearer to the sella turcica by three-fourths inch, and avoid the above mentioned difficulty. To place the procedure on record I will present this report:

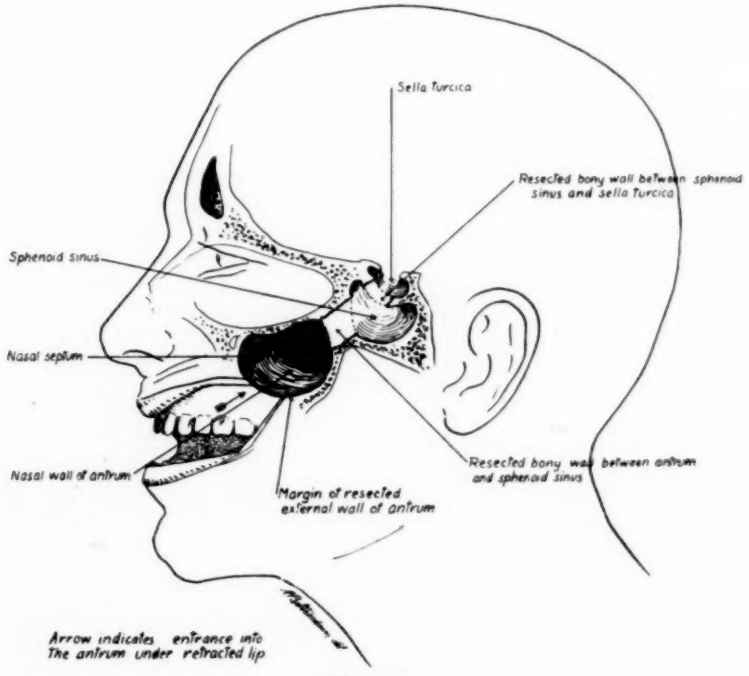
Sella Turcica
Resected bony wall between sphenoid sinus and Sella Turcica
Sphenoid sinus
Nasal septum
Nasal wall of antrum
Resected bony wall between antrum and sphenoid sinus
Margin of resected external wall of antrum
Arrow indicates entrance into The antrum under retracted lip

Figure 1.

This is a schematic drawing of the head (Fig. 1); the lip is drawn up; in other words, the operation is the Jansen method of reaching the sphenoid through the antrum. I propose to reach the sella turcica through the antrum, it being much easier than through the septum, by making a large exposure of the antrum and doing a preliminary middle turbinectomy and ethmoid curettement. We are then at the posterior border of the septum. We now attack the lateral angle between the posterior ethmoid cells and sphenoid; that region which has the sphenopalatine artery in it. After the sphenoid is reached and its anterior wall removed we get into the sella turcica by opening its floor. We reach the tumor in a more direct way and more easily than we would through the septum no matter how far you spread it. I have a case under my care now in which

I have made the diagnosis of a tumor of the hypophysis and have already performed the intranasal operation (preliminary middle turbinectomy and ethmoid curettement), and I propose to follow the transantral route.

Dr. E. C. Ellett, Memphis: On account of the fact that apparently only a few of these cases are seen, I want to report one which has

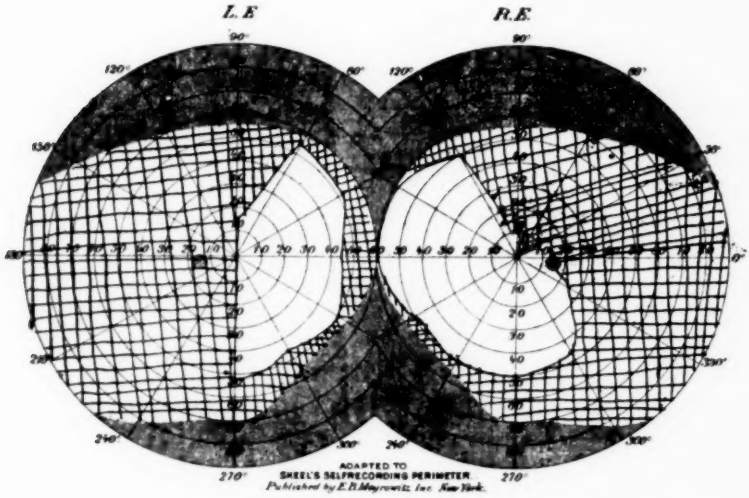

Figure 1.

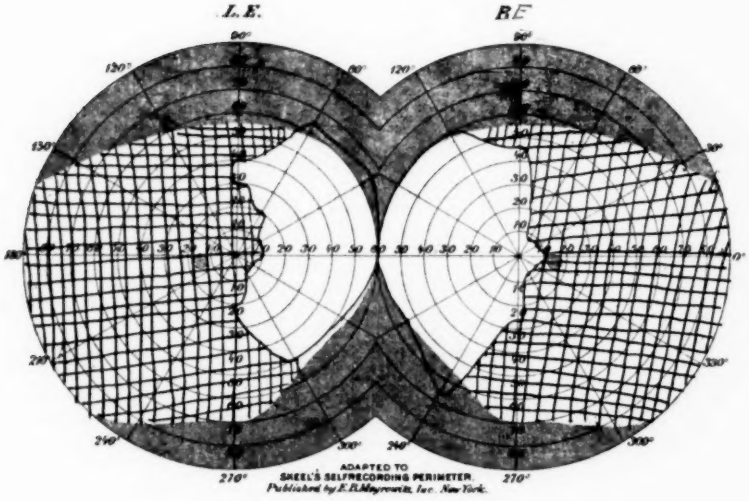

Figure 2.

recently been under my observation. A lady, aged 44, came to me on account of failing vision. This was the only symptom she was troubled with. Her vision was 20/60 partly and 20/200, very slightly improved with glasses. There was bitemporal hemianopsia with a contraction of

the remaining field, partial atrophy of the optic nerves, and marked symptoms of acromegaly. She was not aware of these symptoms, but I have known this lady for some years, and the change in her appearance was quite striking. I secured some photographs of her, one taken when about 18 and one when about 28 years of age, and compared them with her present condition; there could be no question about the change in her features. The x-ray showed a marked enlargement of the sella turcica, and the changes in the terminal phalanges, which Cushing regards as characteristic—a tufted condition as he describes it in his book. This lady was referred to Dr. Cushing for operation, and he operated the first part of July. There were some surgical complications, and she had a stormy convalescence.

Since her return home her vision is very much better in the right eye, in which she sees 20/20 m, but in the other it is very much worse. The changes in her fields may be seen in the accompanying charts.

In the short time that has elapsed, no considerable change could be expected in her appearance. This is, of course, Dr. Cushing's case and no doubt will be reported by him if he considers it of sufficient importance.

Dr. H. G. Langworthy, Dubuque, Iowa: I have been very much interested in the paper and discussion, dealing as it does with the method of approach to the sphenoidal sinus and pituitary body, as I myself am interested in a method of approach to the cavernous sinus. Some eight or nine years ago I began a cadaver study of the best method of approach to the cavernous sinus as published in the *Boston Medical and Surgical Journal*, April 25, 1907. It seems to me, looking back over those few years and reading the papers of general men about the country, the surgeon as a rule made too much of the work and at times increased the difficulties of an already difficult task. From the anatomical knowledge which I possess, it would seem to me that a two-stage operation would be better, first removing your nasal structures and anterior wall of the sphenoid, especially structures about the anterior sphenoid wall, and later attack the pituitary body. I never could understand why so many men try to figure out an elaborate approach to the cavernous sinus, sometimes through the opposite side of the antrum, sometimes through the frontal bone as well as following the gasserian ganglion route. On the cadaver it is very easy to remove the turbinates and go into the cavernous sinus with no trouble at all. It would seem to me that the rhinologist in the future would be the man to take up much of this work, because he possesses a more intimate knowledge of the structures surrounding the body of the sphenoid. I am led to comment on this paper not because I have had special experience with the pituitary body, but because I can see clearly that in the future we are going to have other structures to deal with about the hypophysis such as a thrombosed cavernous sinus.

Dr. W. E. Sauer, St. Louis (closing discussion): Dr. Beck called attention to the difficulty in removing the posterior end of the septum. The conditions in a case of this kind with a large sphenoid make it much easier than operating on a normal cadaver. It was a comparatively easy operation. Dr. Beck describes his own operation here. I wish to say that Denker has described practically the same route of attack. Preysing said he had opened the sphenoid by that route fifteen years ago.

ATROPIA IN THE TREATMENT OF ACUTE RHINITIS

GEORGE A. WEBSTER, M.D.
BOSTON

Acute rhinitis may be the starting point of so many serious conditions that in these days of preventive medicine a discussion of its treatment seems pertinent. I do not desire to dwell on details with which you are all familiar, and shall endeavor merely to bring out those points that bear on the subject of this paper.

In acute rhinitis we have locally congested capillaries of the nasal mucosa, with swelling of the tissues, lessened secretion, with dryness of the surface, then increasing swelling with increasing serous secretion, developing the stage of coryza. We have an exudate into the submucous connective tissue, with locally an increased number of white cells. The serous discharge contains an excess of salines, and is irritating to all surfaces with which it comes in contact. It may contain red blood-cells and leukocytes, with degenerated cells of the mucous membrane. We now have the purulent stage, with the secretion gradually becoming more mucoid.

We are apt to find in the beginning a variety of microorganisms. As the inflammation progresses, certain ones become predominant. Most commonly we find the pneumococcus, streptococcus, micrococcus catarrhalis, the influenza bacillus or the bacillus capsulatus. The bacteria under favorable conditions multiply with great rapidity.

We have an infection in which the body suffers both locally and generally. Locally we have the invasion of the bacteria and generally the action of the toxins produced by them. Bacterial invasion results in cell activity, shown by cell movement and phagocytosis. Leukocytes and tissue cells can take bacteria into their protoplasm and destroy them. While the exudates may have bactericidal properties, and may act as diluting agents to wash away the bacteria, there is still a question whether on the whole the exudation is really a defensive process or a result of tissue damage.

The local tissue changes produced by bacteria are twofold. We have first those that represent the process of resisting and

overcoming the infection; second, those that represent tissue damage. The toxins or chemical products of bacterial development, either directly or through the medium of ferments, become diffused throughout the system, producing fever and abnormal conditions of the circulatory, respiratory and nervous systems. The ability to assimilate nutrition is lessened by the poisoning of the digestive glands. The bacteria may die or become harmless in unfavorable surroundings, but are actively resisted, overcome and destroyed largely by phagocytosis. The toxemia is overcome in a variety of ways, but in general, we may say, by the formation in the body of antibodies or antitoxins which neutralize the antigens or toxins. The local and general vitality affect largely the susceptibility to infection. The results of infection depend in part on the dose of the infecting agent. The tissues can resist a certain number of pathogenic organisms. The larger the dose the more serious the results. A small dose of toxin may produce a reaction which results in throwing off the infection, while a larger dose may overcome the defensive mechanism.

Now let us consider the action of atropia and its relation to these conditions. In moderate doses it diminishes all secretions except the urine. It not only lessens the secretion of gastric juices, but also lessens the percentage of hydrochloric acid. It dilates the pupil, stimulates the brain and spinal cord, quickens the pulse, stimulates the respiration, and increases peristalsis. It is sedative and anodyne. Applied locally it is analgesic and antisecretory. Taken in larger doses, it produces widely dilated pupils, possibly double vision, dry, burning throat with difficult deglutition and intense thirst which nothing allays, also burning in the stomach, nausea and giddiness. The action that is particularly desired in acute rhinitis is to lessen the nasal secretion during the stage of coryza. For this purpose its administration, alone or in combination with other remedies, usually in the form of rhinitis tablets, is recommended by most authorities. Some, however, caution against its use for too long a period, on the ground that it interferes with getting rid of thickened secretion, which then tends to accumulate in the accessory sinuses if infected.

My chief purpose in this communication is to recommend the use of atropia in acute rhinitis during the stage of coryza, not by internal administration, but by local application. Its use in this way is mentioned by a few authorities, but so far as I can learn, atropia is not generally used in this way. Its local action on the eye has been utilized for testing the vision, and no one

would give atropin or homatropin internally to dilate the pupil for this purpose. If we use atropin locally in the nose, the local action in lessening the nasal secretion is relatively much increased, and the general action of atropia is relatively much diminished. I have used it almost exclusively in this way for a number of years, with great satisfaction to myself and my patients. My method is to have the patient dissolve a hypodermic tablet of atropia, 1/150 to 1/300 gr., in ten to fifteen minims of water and spray into the nostrils, repeating this every hour until the secretion is controlled, then discontinue and use from time to time only as necessary to control the coryza.

Used in this way I believe the following results are obtained: 1. We get the maximum action of atropia in the nose, which is desired, and the minimum general action, which is not desired. 2. We control the coryza, to the great comfort of the patient and of all others who come into his presence. 3. Owing to its local analgesic action, there is less sense of nasal discomfort. 4. The local swelling is diminished, and the nostrils remain more patent. 5. The stage of suppuration is less pronounced.

The results are much better if the treatment can be commenced at the first moment the coryza appears. This can only be attained where we have repeated attacks to deal with, so that our patients can be instructed before the onset of the attack. Treated in this way we have, in place of a nasal cavity full of secretion containing numberless bacteria and loaded with toxins, which are continually being swallowed, a comparatively dry cavity, in which the dose of the infecting agent is very materially limited, thus giving the patient a better chance to overcome it locally by phagocytosis, and generally by his conserved vitality.

The cases that show the best results from this treatment are those that start with a simple coryza. Less so are those that have a pharyngitis first and a coryza later. Least favorable are influenza cases with marked general constitutional symptoms. Used as suggested, I believe atropia to be of great value in acute rhinitis. But though I have limited my remarks strictly to the subject under discussion, I desire to emphasize the desirability of other appropriate treatment as indicated by the symptoms and conditions in each case.

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DISCUSSION

DR. T. R. CHAMBERS, Jersey City: The reader of the paper did not mention anything about idiosyncrasy. Two weeks ago I had a physician with an antrum full of pus and in getting into the antrum I used atropin locally. When he came the second time I wanted to use it again, but he asked me not to use it. He stated the resulting dryness lasted twenty-four hours. I only used 1 drop of a 4 per cent. solution, on a cocain saturated cotton-tipped probe.

DR. H. G. LANGWORTHY, Dubuque, Iowa: I rise to discuss this paper because head infection is such a common affection that we are all deeply interested in its treatment. The doctor is certainly to be commended for his attempt to add another therapeutic measure from what seems sound scientific reasoning. However, we have all tried atropin in cases where it failed dismally, and in other cases early in the disease, where it responded beautifully. Some way or another a head infection seems to be self-limited, and it is pretty hard to make deductions as to the real value of treatment unless other drugs are also used in the way of control tests. I doubt whether many here have tried topical atropin applications in the nose, but we can get a little line on it perhaps from the use of atropin in connection with eye-work. I have noticed in treating certain eye conditions, say an iritis, where the patient has had a so-called "cold," that in dropping the atropin frequently into the eye that the patient will, of course, get atropin into the nose and throat through the tear canals, producing a dry nose and throat, and yet I could never see that in these cases the head cold was either aborted or materially helped. I have no doubt that the lessening of secretion temporarily and ability to breathe better for the moment was comforting but the last word on the treatment of acute rhinitis has, I am afraid, not yet been said.

THE VIOLET RAY AND OZONE OF USE IN NOSE, THROAT AND EAR CONDITIONS

KATE W. BALDWIN, M.D.
PHILADELPHIA

So much is claimed for the violet ray, and so much is said against it, that I hesitate to bring its use before the members of the Academy. My excuse for so doing is that I am convinced that all who are not utilizing it for both treatment and diagnosis are neglecting a valuable aid. For diagnosis alone it is worth investigation by the specialist, the internist and the surgeon. It may help the internist and the surgeon to eliminate many supposed points of pain, and to narrow down to a small part of the anatomy the true focus of many widely disseminated symptoms. What is true for the surgeon and the internist is equally valuable for the nose, throat and ear specialist. It localizes pain almost to the exact point most involved.

That which the patient describes as general frontal headache is localized in one or both frontal sinuses; or the sinus may be demonstrated free, and the pain traced to the exit of the supra-orbital nerves. Again, one nerve may be eliminated, and the other found extremely sensitive to the ray. Usually some restricted area that is more acutely sensitive than any other is isolated. With treatment the pain or soreness disappears from the periphery of the involved area first, and later from the actual tissue involved. Having thus localized the area, the etiology — local, general or both local and general — is more easily determined, and must be carefully searched for, and if possible removed, otherwise the relief from pain may be only temporary. Dislike of the violet ray is not frequent, but is very decided when it exists. I do not wish to weary you with details of cases, so I will merely mention three which will indicate the general character of the cases and the scope of the treatment:

CASE 1.—Miss C., teacher, had for many years been subject to extremely severe right-temporal and frontal headaches, which were more frequent and more severe when the general system was overtaxed, and resulted in great exhaustion. The various headache remedies relieved the attacks but did not diminish their frequency or severity. Although the first use of the violet ray quickly cured one of her most severe seizures, so great was her dislike for

it that she preferred to continue to rely on the less prompt relief obtained from drugs. During the next six or eight months I saw her occasionally, but gave no violet ray. Finally, Miss C. reported that not for years had she experienced so few or such mild attacks of headache as since the use of the violet ray. "As every condition," she said, "has been the same since that time as before, the improvement must be due to the ray." Her dislike for the treatment was not less, but she wished to make further trial in order to see whether possibly her headaches might become wholly a past experience. The result was that in spite of her aversion each application was followed by a recognized feeling of comfort. Commencing over the cervical nerves, I gradually diminished the current, reaching the especially involved area with a very mild application, and then gradually increased, until the point of easy tolerance was reached. After only four treatments she left for her summer vacation. The first of September I received this report: "The best ever! Do not mind at all that it is time for school."

Case 2.—A boy aged 10, with chronic suppurative otitis media, probably from the time of erupting his first teeth. There was a large perforation of the lower anterior segment of the drum membrane, with much and frequent foul discharge. The adenoids had been removed without improving the aural condition. No further operation on nose or throat was indicated. After carefully cleansing and disinfecting, used ozone, as generated by the violet-ray apparatus, directly in the ear. It passed freely through the eustachian tube into the throat; also gave it through the mouth and nose. In a surprisingly short time the discharge stopped and the perforation closed. An attack of measles interrupted the treatment, but much to my surprise there was no relighting of the aural infection. The surface electrode was used over the mastoid and in front of the ear.

Case 3.—Dr. N., dentist, came in one evening with a very uncomfortable sore throat, temperature, and much general distress. The tonsils and lateral folds were well covered with a grayish-yellow exudate, suggestive of serious infection. After cleansing the area involved, the throat electrode was thoroughly used over all the exudate, and the surface electrode down the spine, especially the cervical region. Cutting off all appointments for the next day was advised, and an early morning report requested. The morning telephone message was a surprise, in that it reported entire relief from discomfort and absence of exudate in the throat. I insisted on personal judgment, and found no trace of exudate and no fever. Nothing further developed.

The harsh, nervous cough, with or without an enlarged lingual tonsil, is usually greatly relieved, enlargement of the thyroid gland diminishes, and distressing symptoms are removed. Even broken down tuberculous cervical glands respond in a satisfactory

manner. It increases the circulation and relieves pain, and must destroy germs, otherwise the septic conditions would not clear up so quickly. It is being used to sterilize water and milk. Have never used it without beneficial results. In using the ozone, the operator may have transient symptoms of acute coryza.

I am very anxious that a free discussion follow, and that favorable or unfavorable reports be given.

DISCUSSION

Dr. H. L. Pollock, Chicago: This paper has been of much interest to me because I have been doing quite a little work with the violet ray. Dr. Baldwin does not describe the kind of apparatus used. The most powerful one is the Chromyer, which is nothing more than a large arc light with mercury contacts. This has not given as much benefit as the new lamp, called the Quartz, in which the two electrodes have between them liquid mercury which forms the violet rays. At the recent International Congress, Rollier presented his paper on artificial sunlight. He has had most excellent results in his sanatorium on the Alps in the treatment of surgical tubercular conditions with the direct sun's rays. He begins by exposing his patients to the sun's rays for half an hour the first time, then gradually increases the time so that after two or three weeks or a month's time they are naked and taking the direct sunlight, over their entire body. He gave reports of wonderful cures of these tubercular conditions. Out of 365 days he has about 280 days of bright sunshine, and during the short time the weather is cloudy, he uses this quartz mercury lamp. And at the same time Volpius of Heidelberg, who has a similar apparatus in his sanatorium on the mountain, found that in tubercular conditions he had better results by using the lamp than by using the sunlight; that is, he could use the lamp each day, whether the sun shone or not. He gave most astonishing results in these cases of surgical tuberculosis.

About six or eight weeks ago we installed one of these lamps at our hospital and I have used it on three patients, one of which was very interesting.

A young lady came with nasal hemorrhage and the usual ulceration was found on the lower portion of the septum, which was cauterized several times without any result. A submucous operation was performed with no result. Following that the flaps were again separated and the superior maxillary crest was cauterized with the actual cautery, but the hemorrhages continued. At the time of the cauterization, she had two large glands on the left side and the left tonsil was enucleated under local anesthesia. The tonsil was sectioned but no tuberculosis was found, still the glands continued to enlarge. We gave her a tuberculin injection which was positive. I gave her three-minute treatments with the quartz lamp and increased to five, then ten minutes, and after five or six treatments the hemorrhage disappeared. (Since this was reported, the patient returned and informed me that she has had several slight hemorrhages but of no consequence as she is gradually becoming stronger. The glands have almost entirely disappeared and the treatments are being continued.)

Another case was that of a man 40 years old, with a growth above the epiglottis, diagnosed as carcinoma. He had a gland taken out at the angle of the jaw under local anesthesia, and we found a broken-down tubercular gland. A diagnosis of tuberculosis of the throat was made.

In two weeks with this lamp, the size of the growth had disappeared from that of a hazelnut to a small pea.

The rays of this lamp are supposed to be the same as those of the sun at a height of 2,500 feet. Those cases in which the best results are obtained are those in which pigmentation occurs; in those cases where pigmentation does not occur, the conditions do not improve.

DR. W. L. BALLENGER, Chicago: I have for some years been using a very mild form of violet ray in the so-called 500-candle-power, leucodescent lamp, and I have made certain observations in reference to this form of treatment. I have, for instance, used a 32-candle-power lamp with exactly the same kind of reflection back of it and there is not the same result with the 32-candle lamp as with the 500-candle lamp. The rays of these lamps have been tested in one of the laboratories of Chicago and it is shown there was no violet rays in the low-candle lamp, but in the 500-candle lamp there is a considerable amount of blue-violet rays.

Now as to the effects of these lamps. I have tried all night to cure a toothache with the 32-candle lamp without result, but with the 500-candle lamp it melted away like snow. I have also tried it in coryza. Once I had the pleasure in the midst of a coryza of using seven or eight handkerchiefs on my way from home to my office and twenty minutes' treatment with the 500-candle lamp made my nose as dry as it is at this moment. In other instances it has given great relief, but did not cure. In chronic antrum conditions with polyp, I have tried it, and at the end of two weeks there was no discharge and pain had disappeared, but the antritis recurred later on. In my own family I had a case of gall-stones, the pain of which one-fourth grain morphin would not relieve, but the 500-candle lamp did, without the disagreeable effects of the morphin. In chronic conditions it only relieves pain and diminishes the purulent discharge. In chronic mastoiditis I have had very little results from the light used in this way. It seems, in applying it to sinuses, you must apply it over the eye of the affected side, passing it to and fro for twenty minutes. I was interested in Dr. Baldwin's paper, and imagine the principle involved in the treatment is the same, hence I wanted to make this observation.

DR. A. M. EARL: I have in my office a 50- and a 500-candle lamp. My experience has been the same as Dr. Ballenger's. With the 500-candle lamp I relieve otitis media and also some cases of acute mastoid trouble. I use it in corneal ulcers with considerable success, especially where there is a sluggish tendency. I have never had any experience with it in treating acute coryza.

DR. THOMAS FAITH, Chicago: I have had absolutely no experience with the violet ray. I was much interested, however, in Dr. Baldwin's paper.

I think, however, that Dr. Pollock's conclusion should not be allowed to go without challenge, as I personally would attribute the good results to the use of tuberculin. He gave the tuberculin for diagnosis. He had a general reaction and improvement usually follows the use of tuberculin, whether we get a local or general reaction. I do not mean to doubt the efficacy of the apparatus or of the violet ray as Dr. Baldwin described. In connection with Dr. Ballenger's statements, I have personally had some very pleasing results from the use of the large therapeutic lamp; there is relief from pain, but no permanent relief in the condition.

DR. K. BALDWIN, Philadelphia (closing discussion): My paper did not refer at all to treatment by the leucodescent lamp. My use of the violet ray has been entirely in connection with the high frequency electric

current with the vacuum electrodes. The electrodes come in different shapes and sizes. In going into the nose or throat you will need to have an insulated electrode so that the current is carried to the end of the electrode and will not fly off to the parts you do not wish to touch. It is always unpleasant if you turn your current on before you have placed your electrode in contact with the parts. This is not necessary; if you put the electrode on quickly and do not get a spark. I have used ozone as generated by the high-frequency current directly in the ear and forced the ozone through the Eustachian tube into the throat when there is perforation of the drum membrane. I have never used an electrode in the ear beyond the very external portion, but in those cases where I have used the surface electrodes, they were placed directly on the part involved, working up to the portion involved from some distance away. I find in almost all cases a spinal treatment in connection with it is of comfort to the patient.

THE INTRANASAL TREATMENT OF DYSMENORRHEA, WITH A REPORT OF NINETY-THREE CASES

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In 1897 Fliess[1] first called attention to the hitherto unknown and remarkable results obtained by treatment of the nose for the relief of dysmenorrhea and labor pains. In the same brochure he presented a series of facts tending to prove the existence of a periodicity in human life, stated to be twenty-eight days in the female and twenty-three days in the male.

The relationship between the nose and uterine organs was limited, according to Fliess, to certain points in the nasal mucosa which he termed the "genital spots." These are the tuberculum septi and the anterior portion of the inferior turbinate on either side of the nose. At menstruation these swell, bleed easily, are sensitive to the touch of a probe, and are slightly cyanotic. During labor he noted a swelling of the erectile tissue of the nose at each uterine contraction.

His first experiments were with cocain. During an attack of dysmenorrhea, applications of a 20 per cent. solution were applied to the genital spots; the pains in the back and abdomen ceased after five to eight minutes, and did not return until the effect of the cocain wore off. If the turbinates only were touched, the headache ceased, but not the abdominal pain. If one side only was treated, the pain on the opposite side of the abdomen only was relieved. Similar results have since been obtained with adrenalin by the writer[2] and with menthol by Fliess and Kuttner.[3]

Fliess endeavored to secure permanent effects, and applications to the genital spots were made of trichloracetic acid, the galvanocautery, and bipolar electricity, and were entirely successful, as the succeeding menstruations were painless; his best and most lasting results were obtained by the abolition of the sensitive spots by means of bipolar electrolysins of from 5 to 8 milliamperes.[4]

1. Fliess: The Relation of the Nose and Female Genitalia, Leipsig, Vienna, 1897.
2. Mayer: Centralbl. f. Laryngol., 1902, p. 243.
3. Fliess and Kuttner: Centralbl. f. Gynec., 1908, p. 981.
4. Koblank: Deutsch med. Wchnschr., 1908, xxiv, 1046.

Fliess naturally presented his own theories as to the explanation of this remarkable relationship, and these views have been combated by many subsequent writers, the most recent of whom, Seifert,[5] concludes as follows: 1. There are many indications pointing to a direct relation between the nose and the sexual organs; the nerve path is unknown. 2. General circulatory and mechanical conditions have a greater or lesser modifying influence on the nose as a result of sexual conditions and functions. 3. Many pathologic conditions of menstruation coexist with a genuine nasal reflex neurosis or nasal hypertrophy, with its results. 4. Uterine influence through nasal conditions may be largely explained by suggestion, by cocain euphoria, greater in certain individuals than in others, by relief of a nasal reflex neurosis, and through the restoration of the general health as a result of restored nasal respiration and relief of nasal congestion.

It must be added that Seifert's experience with the treatment of dysmenorrhea is so slight and inconsequential that his conclusions and theories lack the weight that a greater experience would give. The subject has aroused intense interest on the part of gynecologists as well as rhinologists, as may be noted by the fact that Seifert's article entitled, "A Critical Study on the Relationship between the Nose and Sexual Organs," in a recent number of the *Zeitschrift für Laryngologie*, has references to 296 articles written on this subject.

Although the nasal treatment for dysmenorrhea has been followed by the writer in some desultory cases with more or less success, it was not until the fall of 1910 that a careful and systematic study of each case so treated was begun.

In conjunction with Dr. Joseph Brettauer[6] of this city, and other noted gynecologists, the absence of uterine disease as a causal factor was ascertained. In some instances all the well-known methods of surgical intervention, dilatation, curettage, etc., had been unsuccessful. Concise histories were taken as to the conditions existing, whether premenstrual, during, or postmenstrual; by far the greater number having premenstrual headaches and nausea from one to two weeks before the period, to be followed by abdominal pains during the first two days, often of so severe a nature as to compel them to go to bed, losing at least two days each month. Some of them had only a fortnight of reasonable comfort, when their sufferings were repeated. The

5. Seifert: Zeitschr. f. Laryngol., Rhinol., etc., p. 431.
6. Brettauer: Surg., Gynec. and Obstet., September, 1913, p. 381.

date of last menstruation and probable date of the next was taken, and the treatment in the majority of instances was given between these two. The nasal examination revealed in a few instances marked stenosis from deflected septa, hypertrophy of middle turbinates, etc., and enchondroses of the septum. All of these patients recovered so completely and permanently after operation as to enable a favorable prognosis in each instance. In the greater number of cases, however, there was no stenosis whatsoever, but a decided tumefaction and engorgement was noted about these "genital spots," and in these the likelihood of benefit to be obtained was believed to be apparent.

In some of the cases treatment was instituted at the time of menstruation when the pains only existed then, and these patients received local applications of cocain to their sensitive spots during the first or second day only. The relief occasioned was often truly wonderful, and the bald recital of pain, treatment and relief tells so little. When we recall the extreme pallor of one of these sufferers as she slowly dragged her way to the office for treatment, her firmly compressed lips and utter weariness, and then, within a few minutes after a local application to her nose, her color comes back, her breathing is free, and she goes about her duties instead of to bed as usual, we feel that we have earned her gratitude. We found that this treatment had to be repeated each month, and therefore ceased the cocain experimentation and used the galvano-cautery or the trichloracetic acid. The results obtained by the latter were so permanent, the danger of forming synechia did not exist, so that the latter series were all treated with the trichloracetic acid. A mild solution of cocain was applied immediately previous to the use of the acid. The slough that forms disappears in about five days, and four applications were made between periods. The patient was then requested to report results of her next menstruation. If entirely favorable two more reports were requested, and if these remained as favorable nothing further was done. In those cases where relief was slight or not at all favorable, four more applications were made between menstruations, and if no benefit was obtained the result was noted.

While the histories of these cases are subjoined, the following cases are illustrative:

Case 2.—A. K., aged 25, single. Menstruation always painful first two days, compelled to go to bed and take full doses of codein. Two large enchondroses of the septum removed and galvano-cautery

to sensitive spot. Reported three years later has never had menstrual pain since.

Case 3.—C. S., aged 24, single. Severe headache and nausea one week before each menstruation, severe bearing-down pains first two days, with nausea and headache, incapacitated for work, and compelled to go to bed at least two days each month. Has enchondrosis of septum and both inferior turbinates swollen. Operation and subsequent treatment cured this patient.

Case 13.—M. H., aged 28, married eight years, no children. Excruciating pains immediately before and until menstruation begins; has been curetted four times without obtaining relief. Has deflection of the cartilaginous and bony nasal septum. Resection, galvano-cautery. Report six months later that she has menstruated regularly and painlessly. Six months later reports herself four months pregnant and subsequently brought her baby, a fine, healthy child, to my office.

Case 29.—F. G., aged 31, single. For past two years severe menstrual pains first day only; incapacitates her. Unwell at the time and cocain applied stopped her pain. Three months later pain recurred; cocain and trichloracetic acid applied. No recurrence of pain.

Case 74.—F. L., aged 41, married. Severe headaches four days before each menstruation, with nausea; relief obtained only by the hypodermic injection of morphin. Eight applications of trichloracetic acid to sensitive spots between menstruations. Reports complete cessation of headaches since last treatment.

The cases here subjoined form in part the basis of two articles by Brettauer, the second one is entitled "A Further Report of Cases of Dysmenorrhea Relieved by Nasal Treatment." He says, "After communication with all patients treated within the last three years, I find that over one-half were afforded immediate relief, permanent relief in over one-third, so that doubt as to the value of the treatment is impossible. These were all in young women, married and single, for whom all the recognized means for the relief of dysmenorrhea had been previously employed and whose pelvic organs presented no organic lesions. One group stands out prominently; those characterized by premenstrual headache, nausea and colic at onset of flow. This symptom-complex was completely relieved. I consider this treatment of great value and one which should be resorted to in all cases of dysmenorrhea where pelvic disease is absent."

In all of the ninety-three cases, the greatest care was taken to eliminate the possibility of suggestion, and no promises were ever made. On the contrary, the briefest explanation that some had been benefited, and it was hoped that they also might obtain

relief. A number of the patients were treated in the dispensary, a place where none could be accused of extended conversation or statements; nor can any weight be given to the theory of cocain euphoria thus blunting the patient's judgment, for by far the greater number received but little cocain, and none at all at the time when their sufferings were due.

That a measure of relief is obtainable by the relief of nasal congestion is very apparent in that every one with pathologic conditions in the nose was permanently cured after their removal, but the manner in which this is occasioned is still an open question.

Of the ninety-three cases whose histories are here briefly presented, no report was received from twelve, leaving a total of eighty-one cases reported on. Of these no relief was obtained in nineteen; improved, fourteen; cured, forty-eight. A cure of 60 per cent. of the cases treated, with benefit to a total of 75 per cent. Three were treated because of amenorrhea, lasting for from three to twelve months, and in each the flow became regular; four became pregnant, two for the first time. One-half of the whole number were married. These results are given from the reports made by the patients after treatment.

The conclusions arrived at as a result of a study of these cases are: 1. Permanent relief is obtainable by intranasal treatment in from 50 to 75 per cent. of the cases. 2. Trichloracetic acid applied to the genital spots four times at intervals between menstrual periods is usually sufficient to obtain lasting results. 3. It affords an additional field of usefulness to our therapeutics.

These patients were from every walk in life. We state the bare facts of the cure of a large number of these patients, but we should bear in mind that all of these suffered inordinately, for most women accept some pain at menstruation as a matter of course, and it is only after the suffering becomes unbearable that the physician is consulted, hence their relief without drugs, operation and uterine treatment, by a few applications to the nose, adds materially to their comfort and the joy of living.

Case and Symptoms	Treatment	Result
CASE 1.—M. L., aged 23, single. April 13, 1910. Excruciating pain for ten days each month; requires to go to bed, and hypodermics or sedatives. Entered hospital.	Cocain applied three times a day at onset of menstruation and during the same. Pain severe for three days. May 6, galvanocautery; May 15, cautery again. June 15, menstruation without pain.	Dec. 19, 1910. Reports no further recurrence of pain with menstruation.

Case and Symptoms	Treatment	Result
CASE 2.—A. K., aged 25, single. Oct. 5, 1910. Menstruation always painful; has to go to bed; vomits; takes large quantities of codein. Has two large enchondroses of nasal septum which were removed.	Cautery to sensitive spots of the nose.	All menstrual pains have ceased; has not been compelled to go to bed, and required no sedatives.
CASE 3.—C. S., aged 24, single. Oct. 12, 1910. Dysmenorrhea very severe; severe headaches and nausea often a week before, and first two days severe bearing down pains with nausea and headaches. Has had enchondrosis of right septum and both inferior turbinates are swollen.	Daily applications of cocain to nose one week before menstruation with result of no preliminary disturbance. Menstruation without pain; never recalls so easy a menstruation. October 29, removed large spur and part of left inferior turbinate. November 13, menstruation with no premonitory nausea or headache and no pain. Remained entirely well for 7 months, when there was much nausea during menstruation. Cautery to sensitive spots.	November, 1911. Has had no pain or discomfort since last note; cured.
CASE 4.—H. N. B., aged 22, single. Feb. 20, 1911. Dysmenorrhea very great; pain beginning 1 hour after flow; lasts 24 to 36 hours.	Cocain applied to sensitive spots at onset of menstruation with results of some relief.	Improved; not seen again.
CASE 5.—P. D., aged 33, single. March 4, 1911. Pain very severe first two days, has been divulsed and curetted; no relief.	Cocain applied at time of menstruation. Galvano-cautery four times between menstruations.	No relief from cocain. Much relief after cauterization. Decidedly better.
CASE 6.—R. A., aged 24, married. March 27, 1911. Severe pain first day; vomiting.	Cocain to sensitive spots for two days in advance.	No discomfort afterward; cured.
CASE 7.—H. S., aged 23, single. April 14, 1911. Dysmenorrhea four days; very severe first day, necessitating rest.	April 15, cautery applied. April 22, cautery again. April 23, menstruation without pain. May 26, pain as severe as before. June 17, cauterized. Next menstruation slight pain and freer discharge. July 29, much pain. August 30, no pain. December 7, pains as bad as ever; to be operated.	Temporary improvement.
CASE 8.—B. L., aged 39, married. April 29, 1911. Has very severe pains for 4 days previous and severe bearing down pains during menstruation for 3 or 4 days.	May 1, two large spurs removed; galvano-cautery both sides. May 20, free menstruation with slightest pain, never severe.	June 14, no pain at all; cured.
CASE 9 (Disp.)—B. S., aged 28, married. May 13, 1911. Severe pain at time of menstruation.	Galvano-cautery applications made to sensitive areas.	Feb. 9, 1912, reports complete cure.

Case and Symptoms	Treatment	Result
CASE 10.—R. F., aged 28, married. June 5, 1911. Pain on right side one week before and first day only.	June 23 and 27, cautery; portion of right inferior turbinate removed.	September 6, reports no relief whatever.
CASE 11.—S. S., aged 23, married. June 5, 1911. Pain so severe, has to go to bed for the first day, requires hypnotics. Two operations, no relief.	Cautery to sensitive spots July 11 and July 18.	August 31, reports absolute freedom from pain. Cured. (Patient has left the city, further report not obtained.)
CASE 12.—R. G., aged 25, single. Oct. 14, 1911. Pain ten days before each period; lasts all night of first days.	Cautery to sensitive spots.	Reports no pain; cured.
CASE 13.—M. H., aged 28, married. Oct. 16, 1911. Married eight years; no children. Pain immediately before and until menstruation begins so severe that she is doubled up. Last menstruation September 26. Operated on four times. Has deviation of cartilaginous septum to the left.	October 17, resection; cautery applied to sensitive spots. October 29, menstruation without pain first time in eight years.	Nov. 20, 1912, reports menstruation regularly since last report; has not had a single day or hour of pain at menstruation times. June 17, reports that she is five months pregnant.
CASE 14 (Disp.).—B. L., aged 21, married. Oct. 20, 1911. Severe pains for twelve hours before and two days during menstruation.	October 20, cautery. November 8, cautery.	No improvement.
CASE 15 (Disp.).—A. S., aged 24, married. Oct. 23, 1911. Dysmenorrhea severe.	Cautery applied.	Decided diminution of pain at next menstruation; cured.
CASE 16 (Disp.).—A. M., aged 26, married. Oct. 30, 1911. Dysmenorrhea one week before and five days during menstruation.	November 12, cautery; severe epistaxis followed. November 25, menstruation.	No relief whatever.
CASE 17.—E. R., aged 17, single. Nov. 1, 1911. Severe pain first two days; irregular; required to go to bed.	Cautery applied to sensitive spots. December 27, menstruation; no pains.	Has been well. Cured.
CASE 18 (Disp.).—I. M., aged 15, single. Nov. 1, 1911. Very severe pains two or three days before and entire period of three days of menstruation.	Trichloracetic acid applied. November 1, no pain. December 5, January 2, trichloracetic acid again applied.	No further pain; cured.
CASE 19 (Disp.).—S. R., aged 27, married. Nov. 1, 1911.	Electro-cautery.	No improvement.
CASE 20.—L. M., aged 38, single. Nov. 23, 1911. Bearing down pains ten days before menstruation, ceases two days before and very severe during flow.	November 23 to 28 and December 8, galvanocautery. December 9, menstruation without pain. December 21 to 28, trichloracetic acid applied.	No further pain. Relief for four months, return of pains, relief temporary.

Case and Symptoms	Treatment	Result
CASE 21.—B. P. E., aged 37, single. Nov. 29, 1911. Pain very severe at menstruation; faints each time; first three days spent in bed. Has deflected nasal septum.	Resection nasal septum on December 12. January, trichloracetic acid applied three times.	Some distress first month (December 14) only; after that greatly benefited; no discomfort; cured.
CASE 22 (Disp.).—R. H., aged 23, single. Dec. 6, 1911. Pain one week preceding period.	December 8, cauterization. December 15, trichloracetic acid applied.	Reports no benefit.
CASE 23 (Disp.).—R. G., aged 23, single. Dec. 6, 1911. Constant pain in abdomen, worse at menstruation for two days.	Cautery applied once.	Reports no benefit.
CASE 24 (Disp.).—M. W., aged 21, single. Dec. 22, 1911. Pain on both sides two days before menstruation, lasting three days after flow; faints from pain.	Trichloracetic acid applied on December 22. December 26, next menstruation, absolutely no pain; two more applications.	June 27, 1912, reports no return of pain since last treatment six months ago; cured.
CASE 25.—M. B., aged 37, married. Jan. 5, 1912. Severe pain first day and lasts during whole menstruation.	Trichloracetic acid applied.	Cured.
CASE 26.—E. M. R., aged 23, single. Jan. 10, 1912. Four hours after menstruation begins and for about five hours suffering is extreme.	Daily cocain applications failed to relieve; trichloracetic acid applied three times.	No benefit.
CASE 27.—M. N., aged 34, married. Jan. 10, 1912. Severe headaches week before, lasts a week during menstruation. Suffers two weeks each month.	Trichloracetic acid applied to sensitive spots; three applications.	No report.
CASE 28.—B. S., aged 31, married. Jan. 15, 1912. Has facial neuralgia second day of menses. Two weeks later pain over right facial nerve; is entirely incapacitated.	Trichloracetic acid applied. January 17, menses lasting three days; no pain. January 20 to 29, trichloracetic acid again applied.	No report.
CASE 29.—F. G., aged 31, single. Jan. 15, 1911. Past two years very severe menstrual pains first day only; incapacitates her. Unwell this day, cocain relieved at once.	Trichloracetic acid applied few hours later, prompt cessation of pain. February 11, menstruation without pain. May 7, no menstruation pains until this day, when she had pain which was promptly relieved by cocain and trichloracetic acid.	June 15, reports herself well; cured.
CASE 30.—A. M., aged 32, married. Jan. 23, 1912. Menstruation very irregular with nose bleed; spasmodic cough.	Trichloracetic acid applied.	No report.
CASE 31.—F. A., aged 27, married. Jan. 23, 1912. Two weeks before menstruation severe pain in mammary glands.	Three applications of trichloracetic acid.	January 26, reports pain in both mammary glands; no benefit.

Case and Symptoms	Treatment	Result
CASE 32.—F. R., aged 28, married. Jan. 24, 1912. Pain begins first day, lasts two or three days.	Three applications of trichloracetic acid.	No report.
CASE 33 (Disp.).—L. D., aged 25, married. Feb. 1, 1912. Severe pain first day of menstruation and a day before.	Two applications of trichloracetic acid.	No report.
CASE 34 (Disp.).—R. B., aged 21, married. Feb. 16, 1912. Pain during first and second day.	Two applications of trichloracetic acid.	Reports herself well at next period; cured.
CASE 35.—C. W., aged 19, single. Feb. 17, 1912. Irregular menstruation; pain first day, at times severe.	Trichloracetic acid applied. Two days later unwell, slight pain.	March, April and May, reports no pain, with regular menstruation; cured.
CASE 36 (Disp.).—J. P., aged 24, married. Feb. 28, 1912. Pain first day, worst on second.	Four applications of trichloracetic acid. No relief. No treatment in April, absolutely no pain. May 20, no pain. June 12, severe pain. Three more applications of trichloracetic acid. Severe pain June and July.	October 28, reports herself very much better, pains not so severe; cured.
CASE 37.—F. H., aged 30, single. March 23, 1912. Pain very severe first day, gradually gets worse; compelled to go to bed for three or four days each month.	Trichloracetic acid applied six times. April 3, slight pain for two days, none after. Four more applications in April. May 2, feels much easier. Rested in bed, could sleep, take food and read. No severe pain. May 27, no cramps, felt comfortable whole period.	Relieved.
CASE 38.—E. F. R., aged 26, single. April 4, 1912. Constant pain on right side; pain begins day before menstruation, lasts two days.	Three applications of trichloracetic acid. Next menstruation with little discomfort, much improved. Next menstruation with pain.	Since that time, while there has been some pain, it has been by no means anything like as severe as formerly.
CASE 39.—A. B., aged 28, married. April 4, 1912. Severe cramps first day of menses; has to go to bed; due to menstruate to-morrow.	Cocain application followed by immediate relief. Single application of trichloracetic acid following day.	July 12, reports that she has been in splendid condition; no cramps and very little tired feeling, cured.
CASE 40.—A. M., aged 29, married. April 5, 1912. Headache prior to menstruation. Severe backaches during whole time.	About to leave city, therefore only two applications.	No relief.
CASE 41.—M. H., aged 22, married. April 12, 1912. Headache three days to one week before and during menstruation. Severe cramps and headache first day. Deviation cartilaginous septum. Operation advised.	No further treatment.	No report.
CASE 42.—E. L., aged 15, single. April 13, 1912. Cramps first day of menstruation.	Cauterization; trichloracetic acid April 15 and 27.	May 7, reports pain somewhat less.

Case and Symptoms	Treatment	Result
CASE 43.—E. G., aged 30, married. April 13, 1912. Severe headache one week before and severe cramps first and third days.	Three applications trichloracetic acid; no improvement at next menstruation. Three more applications, no improvement.	No improvement.
CASE 44.—F. S., aged 32, married. April 16, 1912. Severe pain five days before menses, then six days after for one day.	Three applications trichloracetic acid. Pains next epoch not so severe as usual; two more applications.	Aug. 28, reports cessation of all pain during last three months.
CASE 45.—M. C., aged 38, single. April 17, 1912. Severe headaches at menstruation.	Four applications trichloracetic acid.	No benefit.
CASE 46.—P. F., aged 28, single. April 24, 1912. Irregular menstruation, severe cramps and headaches. Chills two or three days before menstruation.	Three applications trichloracetic acid. May 23, no chills and pain for half a day only before menstruation.	July 6, reports no further chills and condition so slight as not to interfere with daily labor.
CASE 47 (Disp.).—F. S., aged 24, married. April 29, 1912. No children. Pain one week before menstruation, and first day; very scant.	Four applications trichloracetic acid in April and May. May 22, no abdominal pain; slight headache.	September, 1912, reports no discomfort and is now two weeks overdue. December, 1912, about three months, well since.
CASE 48.—F. K., aged 30, married. May 1, 1912. Constant pain in abdomen, worse on right side. Severe pain three or four days before menstruation.	Four applications trichloracetic acid in May resulting in relief; next month no treatment with no resulting benefit.	Temporary improvement.
CASE 49.—S. F., aged 33, married. May 3, 1912. Has one child 8 years of age. Very severe pains at time of menstruation and has vomiting.	Three applications of trichloracetic acid.	August, 1912, reports cessation of pain and vomiting for past three months; cured.
CASE 50.—E. L. S., aged 29, married. May 3, 1912. Has one child. Severe pain for twelve hours first day of menstruation.	On evening of first day of menstruation cocain applied to sensitive spots with immediate relief; another the following morning.	June, 1912, reports menstruation without pain; cured.
CASE 51.—S. L., aged 24, single. May 13, 1912. Severe pain first day with excruciating pain of half hour's duration.	Trichloracetic acid applied.	Reports benefit; cured.
CASE 52.—S. S., aged 24, married. May 23, 1912. Pain half hour before menstruation; lasts three or four days; codein required.	Four applications trichloracetic acid made before next menstrual epoch.	Reports no relief whatever.
CASE 53.—M. C., aged 29, single. May 23, 1912. Pain very severe just before and always with menstruation, requiring opiates.	In May and June cocain given (four applications), temporary relief.	July 30, 1912, reports no relief.
CASE 54.—J. S., aged 28, married. May 27, 1912. Cramps one week before and very severe the first day of menstruation.	Cocain applied at once as she is about to menstruate; also next day, morning and evening; no pain at all first day as in former times.	No report.

Case and Symptoms	Treatment	Result
CASE 55.—M. R., aged 40, married. June 1, 1912. Pain at end of spine. Cramps at menses on fourth day.	One application of trichloracetic acid.	No report.
CASE 56.—M. K., aged 19, single. June 8, 1912. Week before menstruation severe cramps, headaches.	Trichloracetic acid June 8, 11 and 14. July 2, menses appeared one week late; no premonitory pains, none during whole period. Flow much greater than before. First time in years free from pain.	August, 1912, reports menses on time; no preceding pain. Some headache second day. No further discomfort. November, 1912, cured.
CASE 57.—M. N., aged 37, married. June 10, 1912. Constant pain in bladder and all over abdomen. Severe cramps at menstruation, worse first and second days.	Four applications of trichloracetic acid failed to relieve.	No relief.
CASE 58.—F. S., aged 25, single. July 11, 1912. Menstruation severe; goes to bed three days; requires sedatives; two operations without benefit.	Treated with cocain midnight of first day, again following morning without benefit.	No benefit.
CASE 59.—E. L., aged 26, single. Aug. 30, 1912. Dull achy pains for one week before, much irritability. Severe pain first day.	Trichloracetic acid August 30, September 2 and 5.	Unwell without previous pain; cured.
CASE 60.—F. B., aged 20, married. Sept. 7, 1912. Severe pain lasting six or seven hours on first day.	Trichloracetic acid September 7, 14, 20 and 27.	Severe cramps three days before but not severe on the first day as usual; cured.
CASE 61.—S. L., aged 31, married. Sept. 9, 1912. Always painful menstruation, severe cramps one week before, very severe first and second day. Cramps now due, to be unwell September 10.	Cocain to nose; trichloracetic acid after.	Unwell September 15 without premonitory pains.
CASE 62.—R. D., aged 29, married. Sept. 17, 1912. Constant pain in lower abdomen, severe three to four days before menstruation, and still worse the first two days.	Trichloracetic acid September 17, 20, 24 and 27.	No constant pain; very slight disturbances at menstruation; cured.
CASE 63.—E. H., aged 19, single. Sept. 19, 1912. Very severe pain one day before and two to three days during menstruation.	Trichloracetic acid September 19, 23 and 27.	Improved.
CASE 64.—E. S., aged 28, married. Sept. 24, 1912. Cramps eight days before, extreme after flow is established.	Trichloracetic acid September 24, 28, October 1.	October 8, no cramps, four days overdue; cured.
CASE 65.—M. G., aged 19, single. Oct. 5, 1912. Severe pain two weeks before menstruation, six to seven days late.	Trichloracetic acid October 16, 23, 30, and November 4.	No report.

Case and Symptoms	Treatment	Result
CASE 66.—R. S., aged 27, single. Oct. 12, 1912. Severe cramps four to five days of menstruation, pains occur ten days after, pain always after flow is over.	Trichloracetic acid October 12, 17 and 22.	Vastly improved; cured.
CASE 67.—E. L., aged 31, single. Oct. 14, 1912. Severe cramps one week before and first day of menstruation, headache, nausea, vomiting twenty-four hours, flooding two months.	Trichloracetic acid October 14, 19, 24 and 29.	Flow diminished, otherwise no improvement.
CASE 68.—M. B., aged 20, married. Oct. 26, 1912. Severe pain second and third day, operation gave no relief.	Trichloracetic acid October 26, 30, November 4 and 11.	Cured.
CASE 69.—C. C., aged 27, single. Oct. 26, 1912. Very severe pain first and second day, general depression before menstruation.	Trichloracetic acid October 26, 30, November 4 and 8.	Cured.
CASE 70.—D. H., aged 22, married. Nov. 7, 1912. Pain first day of menstruation, due to-day. Sterile.	Daily applications cocain.	No menstruation; pregnant.
CASE 71.—F. M., aged 23, married. Nov. 7, 1912. Severe pain first day, worse the second, due to menstruate.	Cocain two days.	No report.
CASE 72.—F. G., aged 34, married. Nov. 15, 1912. Menstruation one day only, severe headache four days before, during and after.	Trichloracetic acid November 15, 20, 25 and 30.	Flow began without premonitory symptoms, lasted three days; cured.
CASE 73.—S. H., aged 42, married. Nov. 18, 1912. Pain in back almost constant, worse before menstruation.	Trichloracetic acid November 18, 23, December 3, 9, 14 and 19.	Much less discomfort after first two treatments.
CASE 74.—H. L., aged 41, married. Nov. 25, 1912. Four days before menstruation severe headaches requiring morphin, nausea at same time.	Trichloracetic acid November 25, 30, December 3, 9, 19, 23, 28, January 2.	Some headache and nausea but not severe. Last seen Jan. 31, 1913; cured.
CASE 75.—D. W., aged 26, single. Dec. 5, 1912. Headaches two days before menstruation, nausea and cramps.	Trichloracetic acid December 5, 10 and 16.	Ill in bed with general malaise, no headache, no nausea, no cramps; cured.
CASE 76.—M. S. P., aged 41, married. Dec. 9, 1912. Moderate pain, menorrhagia, depression two days before.	Trichloracetic acid December 9, 14, 19 and 26.	No benefit.
CASE 77.—S. G., aged 24, married. Dec. 12, 1912. Severe pain during the whole period.	Trichloracetic acid December 12, 17, 23 and 28.	Great relief.

Case and Symptoms	Treatment	Result
CASE 78.—F. M., aged 24, married. Dec. 13, 1912. Pain very severe before menstruation lasting three to four days. Nausea and fainting, constant pain past year.	Trichloracetic acid December 13, 20, 27 and 31	No report.
CASE 79.—O. M., aged 19, single. Dec. 28, 1912. Menstruation tri-monthly, pain one to two weeks before and during menstruation, last menstruation four weeks before. Amenorrhea.	Trichloracetic acid December 28, January 4, 11, 16 and 23.	Menstruation two days after first application on time for first time in her life, without any pain; great relief.
CASE 80.—J. M., aged 28, married. Jan. 8, 1913. Severe pain first day, headache day before.	Trichloracetic acid January 8, 13, 18 and 23.	Great relief; cured.
CASE 81.—S. H., aged 29, married. Feb. 3, 1913. Constant pain in right iliac fossa two weeks before menstruation, very severe.	Trichloracetic acid treatment.	No relief.
CASE 82.—E. D., aged 43, single. Feb. 25, 1913. Nausea and vomiting after flow is established and at time after flow ceases. Severe headaches.	Four applications of trichloracetic acid between periods.	Only slight nausea two days after menstruation.
CASE 83.—R. P., aged 25, married. March 14, 1913. Severe cramps, suffers greatly first twelve hours.	Four applications between periods.	Cured; pregnant May 10.
CASE 84.—C. B., aged 19, single. March 24, 1913. Severe pains one week before and very severe first and second day, nauseated, sleepless, irregular of late.	Four applications between periods.	Interval diminished, greatly benefited; cured.
CASE 85.—M. L., aged 22, single. April 7, 1913. Much distress ten days previous, pain, vomiting and nausea for twelve hours first day.	Four treatments between periods.	Cured.
CASE 86.—M. F., aged 20, single. April 15, 1913. No menses for over a year, heat flushes. Amenorrhea.	Three applications in April, four in May and June.	Went to country April 25, returning May 17. Menstruated May 20, became unwell July 10 without further treatment; cured.
CASE 87.—L. S., aged 28, married. May 3, 1913. Severe cramps first two days, has them now.	Cocain applied to sensitive spots.	Pain ceased; cured.
CASE 88.—P. S., aged 23, single. May 27, 1913. Nauseated day before and first day of menstruation, deflected septum, operation advised.	Four applications between periods.	No benefit.
CASE 89.—P. S., aged 29, married. June 3, 1913. Cramps, nausea and headaches first two days, compelled to go to bed during all that time.	Four applications between periods.	Cured.

Case and Symptoms	Treatment	Result
CASE 90.—C. F., aged 27, married. June 5, 1913. Amenorrhea eleven months; deflected septum.	Four applications during month; septum resected.	Cured.
CASE 91.—C. L., aged 33, married. July 17, 1913. Severe pain, three days each month spent in bed.	Trichloracetic applications.	No pain and no discomfort.
CASE 92.—H. B., aged 25, single. Sept. 12, 1913. Severe headache and nausea previous to menstruation, cramps, spends first day in bed.	Trichloracetic applications.	No headache or nausea, slight cramps.
CASE 93.—B. W., aged 41, married. Sept. 18, 1913. Severe facial neuralgia three to four days before menstruation.	Trichloracetic applications.	No further pain.

DISCUSSION

DR. J. C. BECK, Chicago: When Dr. Mayer spoke to me about this subject in Minneapolis some time ago I fell into it by saying that I had had some experience. Since I have heard his paper I wish I had not said anything. For after such brilliant results and knowing him so far as his reports are concerned, I hesitate to say what my own experience has been, I will go back and work over again in that line in order to conform to his results. When the subject was first presented to me, (in reading the literature) I could see the same results as the writer of the paper, and yet that has not been universally my result in the treatment. I will say this: I have had in consequence of this study several operations to do on the nose, on the turbinates and the septum because they were pathological. These patients had nasal obstruction, but they were not all relieved of their dysmenorrhea. It is some time now since I have treated such a case.

DR. SEYMOUR OPPENHEIMER, New York: I just want to say one word of corroboration. My experience has been a limited one, being confined to a few cases, but I am familiar with the work Dr. Mayer has been doing. My own experience and results have been entirely in line with what he has given. It is a very peculiar thing. While we may offer some theoretical physiological explanation of this condition, such as a relationship of reflex transmission through the sympathetic nervous system, through the inferior hypogastric and the superior branches of the sympathetic nervous system, yet we have no actual anatomical basis through which these results can be secured. However, it is a proposition which I think is well worthy of a great deal of consideration, particularly in those cases of dysmenorrhea in which the gynecologist feels satisfied there is no organic lesion present in the pelvis.

DR. EMIL MAYER, New York, (closing discussion): I read an excerpt taken from a very recent number of the *Zeitschrift fuer Larymgologie* on the "Pathology and Treatment of Nasal Reflex Neuroses Originating in the Tuberculum Septi." The first case, a young saleslady, with excessive lacrimation, photophobia, and pain in the left eye, lasting ten months. All things possible had been done for her. Galvanocautery applied to these particular spots promptly relieved her. Another series of six cases of headache were cited, in which the trouble was located in the tuberculum septi, and cauterization relieved them.

As this subject is being generally presented the rhinologists of America ought to be in touch with it, and I felt that I should present the results of three years' work to this society. I thought it strange that as many as 296 articles on this subject could appear in the foreign journals and none of us had taken it up.

I am sure that the connection between the nose and menstruation will now be known to the rhinologists of America and seriously accepted as possible opportunities for treatment. Results will be obtained if they will but follow the directions of touching the genital spots only and nothing else: the tuberculum septi on each side and the anterior edge of the inferior turbinates. Touch them with the cautery, after the patient's nose has been made insensitive, and touch them so that you have a spot cauterized probably as large as a pin-head. The patient is then dismissed. It is really remarkable what this treatment will do after repeated curettages and operations have failed. I would like to have them go further and relieve them all, but our therapy has not reached that point.

A PRELIMINARY REPORT ON THE BACTERIAL CONTENTS OF THE TONSIL

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There have appeared from time to time reports of tonsillectomies for a variety of remote symptoms in which much importance was attached to the fact that cultures from the cut surface of the enucleated tonsil gave a growth of organisms usually regarded as pyogenic. The authors of this report have undertaken the study of a series of tonsils with a view to finding out what organisms are usually to be grown under these circumstances. The tonsils are from successive operative cases, not selected at all, and comprise the average run of cases. In the full report, which will be published when a sufficient number of tonsils have been examined, the details of each case as to symptoms, physical signs and results of the operation, as well as the culture, will be given. This report is a preliminary one only, and will give a summary of the facts so far obtained. This report is on thirty-five pairs of tonsils, or seventy glands.

We have reports also on twelve or fifteen other pairs of tonsils which we do not regard, for various reasons, as conclusive, and therefore think these should not be included in this report. We have in the laboratory all the tonsils preserved in 10 per cent. formalin, and the stained smears from the cultures of all, or practically all, of the thirty-five pairs of tonsils which we regard as conclusive.

You will note in this report that we do not state definitely the presence of streptococci or staphylococci, but chains of cocci which are Gram-positive may be regarded, with practical certainty, as being the *Streptococcus pyogenes,* while Gram-positive cocci arranged in irregular clumps may be regarded with equal certainty as being staphylococci. The presence of the Gram-positive diplococci probably means that they are really diplo-streptococci, or related to the streptococcus group.

The following technic was employed: The tonsils, soon after removal, were quickly washed off in a weak solution of phenol (carbolic acid), and then placed in a sterile bottle. The bottles were immediately taken to the laboratory, and the process, as out-

lined below, was immediately carried out; or if this was impossible, on account of lack of time, they were placed in cold storage until they could be "worked up," which was from one to four hours.

The following is the technic in detail as to the manner each tonsil was treated after being taken to the laboratory: Two varieties of culture mediums were employed, Loeffler blood-serum and glucose-bouillon. A scalpel to be used for section through each tonsil was sterilized in a hot air sterilizer. The surface of each tonsil, before section was made, was sterilized by passing back and forth several times through the flame from a Bunsen burner.

Every part of the surface was sterilized. The section was made almost entirely through each tonsil, and then on about the middle surface a sterilized platinum loop was placed and some of the material removed and placed on Loeffler's blood-serum, and then some of the material was placed in glucose-bouillon. Each tonsil was treated precisely in the same manner. The culture tubes were then placed in the incubator for twenty-four or thirty-six hours, and then smears made. These smears were stained by both Loeffler's methylene blue and Gram's stain, with the result as outlined below:

Long and short chains of Gram-positive cocci were found sixty-three times. Gram-positive diplococci arranged in chains were found twenty-four times. Irregular clumps of Gram-positive cocci were found twelve times. Inoculations were negative from four tonsils.

As you see, in a large majority of the cases long and short chains of streptococci only were found. In a fair number of cases these were associated with diplo-streptococci, and occasionally staphylococci were present. In only four of the tonsils was the inoculation negative.

In the majority of these cases the removal of the tonsils was done for the relief of recurrent tonsillitis. They varied in severity, and in a few cases the symptoms were mild, but as the child was undergoing the adenoid operation it was thought wise to remove the tonsils at the same time. No case in this series was operated solely for the relief of joint, heart or kidney lesions, but one patient had, besides local symptoms, slight pains in the knees at times. These have not been present since the operation. This does not take into account the pains in the back and elsewhere that all patients present during an attack of acute tonsillitis.

We do not desire to draw any conclusions from this work until it is completed. The histologic aspect of the matter has not yet

been gone into, but we at least feel that our results so far mean that one cannot draw any very accurate conclusions as to the amount of damage a tonsil may do from the character of the organisms which can be grown from it. If pressure is made on a tonsil, some secretion can usually be forced out of the crypts, and this fluid looks like pus. The formed elements in it, however, are found to be almost entirely epithelial cells, with many bacteria, both cocci and bacilli, the former largely predominating.

DISCUSSION

DR. J. E. BROWN, Columbus, Ohio: The discussion of this paper could better be opened by a bacteriologist or a surgeon who has paid some attention to this phase of the subject. I am not qualified to speak from this standpoint. The paper contains information we are all glad to have. Its closing paragraph brought before you a point I intended to mention in discussing also the previous paper, and that is some distinctions in the matter of tonsillar and peritonsillar pus. As Dr. Ellett has pointed out, in many of our tonsil cases we press out of the gland a secretion which is often mistaken for pus. It is a mixture of broken-down epithelial débris mixed with food particles that accumulate in the diseased crypts of the tonsil; and on manipulation a large quantity of this is often pressed out. It simulates, but is not a true pus. I have rarely found chronic peritonsillar abscess in my tonsil surgery. When found the abscess has usually been a very large one and the dissection of the surrounding tonsil tissues has been excessive, and there was usually antecedent reason for anticipating a condition of the kind. On the other hand, I have, as you all have, many times unexpectedly met with the secretion which has been pressed out from the crypts of the tonsil, but undoubtedly this differs only in its fluidity from the cheesy and semi-solid secretion which is likewise met with, and both of which have the same origin.

In discussing the bacteriology of the enucleated tonsil, Dr. Ellett has made it plain that we can expect to find microorganisms in practically every tonsil which we remove, and this is in accordance with our previously acquired knowledge of the bacteriology of the nose and throat. However, if the tonsil is normally the habitat of the organisms enumerated by Dr. Ellett, why is it that we have them only occasionally lighting up in their activity to create an acute inflammatory process? Certainly these are not due to changes in the tonsil itself. Is it not rather more frequently to be found in a disturbance in the intestinal tract in which toxins are absorbed into the circulation, lowering the resistance of the patient so that the organisms in the tonsil might light up into activity? I am of the opinion that we may have tonsils in two individuals, both with the same micro-organisms, but in one there is practically no local reaction of inflammation or indication of disease, while in the other the throat is the seat of repeated inflammatory and acute infectious disturbances.

DR. M. W. CULLOM, Nashville: I have little to say on this subject except that I am deeply interested in it. In Nashville we believe that an infected tonsil has a great deal to do with systemic disturbances. Dr. Billings of Chicago, read us an interesting paper and started our internists to look closely into these matters, and we think we have found a distinct connection between these diseased tonsils and chronic systemic infections. I have had about a dozen tonsils examined. My technic was not as

thorough as Dr. Ellett's by any means, but we tried to make it as sterile as possible. We took the tonsils on sterile gauze and the bacteriologist used a sterile platinum loop in getting the secretions from the internal structure of the tonsil. Every single tonsil examined was reported on by the bacteriologist as containing streptococci and staphylococci. I remember one case operated on following an acute attack. I operated, I presume a week or ten days after the acute attack, and the culture was interesting. There was a profuse growth of different organisms, and the patient got an infection in the site of the wound that caused a great deal of pain, but he recovered without any trouble.

This is one of the most fruitful subjects that we throat men can study. I think we have merely scratched the surface, and I also think that we are going to find that the tonsil, the appendix and other rudimentary structures are responsible for a great many of our chronic infections.

Dr. Will Walter, Chicago: It so happens that I undertook a similar investigation to this of the essayist. I made it because it did not seem reasonable that the finding of streptococci in tonsils of patients having rheumatism could necessarily be considered proof of their causing rheumatism as claimed and reported by Davis in connection with Billings. My results are very similar to those Ellett reports. In practically all tonsils examined the streptococcus is found in the crypts.

Last summer I had my laboratory examine 100 cases of pyorrhea, and streptococci were found in every case. I think if swabs are taken from the throat you will find these organisms in all throats, though here the streptococcus is morphologically different from those in the crypts. Rosenow has recently undertaken to show that he can change the strain of streptococcus by varying the media or by animal culture, and he even claims that he is able to convert it into a pneumococcus—pneumococcus being a form of streptococcus.

These observations give us a reason for the variation in streptococci when they are found in the pharynx or in the crypts of the tonsils.

The fact that we have such good results in these cases of rheumatism, kidney and heart lesions from the removal of the tonsils, offers strong evidence that the organisms in the tonsil are the cause of the trouble. My conclusion is that the finding of streptococcus in the crypts in cases which have no rheumatism or other evidences of inoculation, is no argument against the thought that they are the cause of these maladies. The tonsil doubtless has a function to perform in protecting the body against invasion, and that many a battle is fought out here is evidenced by their finding. Occasionally these organisms get beyond the tonsil and into the blood-stream and they are the ones, then, that cause these troubles.

As to the essayist's technic, he does not mention whether he takes smears before cultures are made. If we are to classify the bacteria found in tonsils we should make smears, because of the fact that many strains die out in culture when the media are not appropriate.

We have occasionally found bacillus fusiformis and often organisms of the mouth, and other bacteria, many of which do not grow in the culture media he employs. These media should contain some hemoglobin mixture, for the growth of pneumococci and influenza organisms is not reliable on media without it.

Dr. Joseph C. Beck, Chicago: Dr. Walter has again stated the point I wanted to bring out. The work of Dr. Ellett would tend to throw a little chill on the work of Rosenau and the internist, and I think it would be too bad for us to go away with that theory. The work of Dr. Rosenau is most interesting and I want to call attention to the most important

part of his work. Dr. Walter did not bring out in the discussion that the organism we find in a tonsil at the time of removal is not at all the organism you are going to find in a rheumatic lesion. It is a non-hemolytic organism and it gets into the blood, stays there only a short time, and then changes in the blood-stream, in the heart and joints and muscles. They can reproduce these conditions by getting cultures from the blood, and it is important that we take this into consideration.

Dr. R. C. Lynch, New Orleans: I think the tonsil is a small feature in this condition. I look on the tonsils rather as incubators, and it strikes me we have the sinuses, the prostate, gall-bladder and appendix that will incubate these organisms just as well as the tonsils do. I have in mind two or three varieties of this condition. A patient that was operated on by a gynecologist for an appendectomy and suspension or something of that sort. Two or three days after the operation the patient developed a temperature of 105 with a high polymorphonuclear count and no plasmodia. After careful study of the case pus was found in the pelvis of one kidney, which showed Friedländer bacillus capsulated. Not long after that I removed the tonsils of the same patient and found the same organism in the tonsil. I wonder if possibly there is not an association between the tonsil and the lighting up of the kidney lesion? I think the tonsil is just one link in the chain in this process, and if we spend all our efforts on the tonsil and neglect the teeth, gall-bladder, appendix, etc., we are simply going to look at one side without looking at the other.

There is a condition of chronic antrum infection, where the infection is so chronic and gives rise to so few symptoms that it is absolutely overlooked by the patient himself. I had a case of this kind: the man had an arthritis of the shoulder and knee and was finally sent to the country with a plaster cast on his knee, consigned to the tuberculous joint class. He stayed in the country a month without any gain in weight. Finally we found a little plug of sterile pus or mucus in the antrum, curetted that cavity out thoroughly (Caldwell Luc operation) and in the course of another month the patient had thrown off his cast and had gained 14 pounds in weight. So that if we can get at the incubator of the body, wherever it may be—whether antrum or tonsil—we will get absolute relief in these conditions. Certainly the tonsils or sinus infection are associated with such conditions as furunculosis. It comes from a focus of this kind, whether it comes from the tonsil or sinuses or some other incubator in the body. I am sorry the doctor has not studied his cases with more regard to the constitutional state, that we might have some definite knowledge of the associations of the organisms in the incubator with their constitutional manifestations. It would seem barely possible to finally isolate that organism, having special affinity for heart muscle, for instance, and that for the joint and membrane. Should this come to pass what a help it would be and the possibilities of treatment are perfectly apparent.

Dr. H. M. Lokey, Atlanta, Ga.: I was interested in the paper because I have seen a number of cases of rheumatism in consultation with some of our physicians and orthopedic men in which the history showed clearly the rheumatic and heart lesion related to some tonsillar infection. I want to mention just one case I had recently. I was called to the hospital about 11 o'clock at night in consultation to see a lady who had just been brought in. Two weeks previous to this she had had an attack of tonsillitis which had been treated by her family physician. The throat apparently was in a normal condition after that. About ten days follow-

ing this attack she had a small boil, a superficial abscess, practically healed at the time, on the left temple. This was opened and drained by the attending physician, and I was called in to see her on account of an orbital cellulitis of the left eye. The history I got was that her husband had had an infection from Neisser's gonococcus, and the physician feared she had a gonorrheal infection. There was considerable infiltration around the eye, pupillary reaction normal and both fundi normal. I had no way of testing the vision; there was considerable serous secretion from the eye. I had a culture made from this and got a report the next day, a mixed infection of streptococci and staphylococci. The next morning when I saw her the right eye was as bad as the left. On account of embarrassed breathing I examined the heart and found a pericarditis. I phoned the attending physician to go to see her; about 11 a. m. he called me up to know if I wanted other consultation, but before I could get to the hospital the patient was dead from purulent pericarditis.

Dr. W. L. Ballenger, Chicago: The discussion of focal infections gives me an opportunity to correct some exaggerated rumors concerning my own health. It seems I had been suffering from an aggravated pyorrhea alveolaris for a number of years without giving it any attention or significance. As a result of this focal infection I was in a state of chronic septicemia without knowing its cause. About two years ago I placed myself in the care of an expert dentist and to my great delight and surprise the septic condition disappeared. My prolonged septic appearance gave rise to all kinds of rumors as to my health, which of course reached my ears. I beg the privilege of publically stating at this time that the septicemia is entirely cured, and that I am again well, and expect to be with you many more years, doing my share in the furtherance of our growing and splendid society.

Dr. E. C. Ellett, Memphis, Tenn., (closing discussion): One or two things I want to say, and one bears on the question of reports of acute streptococcic sore throat. I think if we make smears, as Dr. Walter suggests, of all cases of acute tonsillitis, not only those with or suspected of having diphtheria, but those that are not, we would find the majority to have streptococcic sore throat. Now what Dr. Walter said about streptococci in pyorrhea is what we would all expect, namely, that you can grow almost any organism from the mouth. If the presence of these organisms in the tonsil means that the tonsil takes them up from the mouth, then it is a question of what we ought to do. If it is a disease-producing process, then all of us ought to have our tonsils taken out. If it is a protective process, why is one benefited by having his tonsils taken out, of which there can surely be no question. I must confess I am still looking for light along these lines as to when to take out tonsils.

A LARGE CYST OF THE EPIGLOTTIS

H. Moulton, M.D.
FORT SMITH, ARK.

According to Mischkin,[7] cysts of the epiglottis occur most often in men between the ages of 18 and 50 years. Crosby Greene[2] of Boston, however, refers to the literature of three cases in infants which caused death by suffocation. No age is exempt. Lenox Brown,[6] Mischkin,[7] Forsyth[3] and others regard cysts of the epiglottis as retention cysts. They are very rare. Noquet[5] says they are rarer than cysts of the vocal cords. Moure[2] reports 117 cases of cysts of the larynx, of which fifty were of the epiglottis. Morrell McKenzie[5] published a drawing of a cyst of the anterior surface of the epiglottis. Several such cases are reported. Most of the cysts described are of small size, less than the size of a cherry, producing slight or no symptoms. Those as large as a hazlenut are quite rare, larger ones very rare. Hamilton[2] of Montreal records one as large as a hen's egg — said to be the largest on record; Beck[1] one as large as a large hazelnut, Greene[2] one that was one inch in diameter.

Most of the cysts reported were attached to the anterior or posterior surfaces of the epiglottis or to the lateral folds leading from the base of the epiglottis to the pharyngeal walls. I find only one case, which was reported by Beale[4] as growing from the glosso-epiglottic fossa, said to be as large as a cherry.

The treatment usually employed has been the snare, avulsing or cutting forceps with or without electro-cautery. Beck[1] resorted successfully to lateral pharyngotomy after the other measures failed.

The case I wish to report bears the double distinction of being one of the few very large ones, and of arising from the very unusual location in the glosso-epiglottic fossa.

Case 1.—Mr. C., a lawyer, aged 37, of excellent general health and the father of healthy children, consulted me on Sept. 27, 1911. Two or three years before he had had a slight hoarseness which soon disappeared. For four or five weeks before consulting me he had been troubled with a gradually increasing feeling of fullness in his throat, which was now beginning to interfere with swallowing and speaking. Laryngoscopic examination revealed a large, smooth, yellowish-red tumor lying between the epiglottis and tongue on the left side. The tumor displaced the epiglottis

backward and to the right side, and extended from the left lateral pharyngeal wall two-thirds of the way across to the other side. Its summit was somewhat higher than the crest of the epiglottis. In size it might be compared to an English walnut. It was firm to the touch and apparently without fluctuation.

In discussing the diagnosis, the probability of its being cystic was considered together with the possibility of its being some such solid growth as a sarcoma or gumma. At my request the patient saw Dr. J. E. Logan of Kansas City on October 6, who punctured the tumor and established the diagnosis of cyst. In four weeks the cyst had refilled. I punctured it again, releasing about an ounce of viscid yellowish mucus. The next time it recurred I attempted to cut away as much of the cyst wall as possible with Kause's cutting laryngeal forceps. Of course, at the first cut the sac collapsed and very little more of the cyst wall could be secured. A curet was pushed into the cavity, hoping to irritate the walls and produce adhesive inflammation. The shape and situation of the tumor precluded the use of a snare.

After several recurrences and attempts to cut away the cyst wall, the final operation was done on April 22, 1912. After opening the cyst this time, as before, the walls collapsed deep into the glosso-epiglottic fossa. The main attachment was a broad one, to the lower part of the anterior surface of the epiglottis, extending down to the bottom of the fossa. With the aid of the laryngeal mirror I was able to get a large electro-cautery point into the cyst cavity, thoroughly cauterizing its walls in every direction. There was moderate reaction which soon subsided. To date, after a lapse of eighteen months, there has been no recurrence. The tissues in the bottom of the left glosso-epiglottic fossa remain very slightly thickened. Otherwise the parts are normal. Cocain was the anesthetic employed.

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DISCUSSION

DR. S. IGLAUER, Cincinnati: I think Dr. Moulton is to be congratulated on the success he had with this colossal cyst. The question, of course, is always how to get at the tumor mass, and he has demonstrated that he can do it admirably by the indirect method. I should like to ask, however, if, as a rule, these cases cannot be treated to greater advantage by the direct method.

In illustration of the fact that we can not always work according to fixed rules, I wish to refer to a case Dr. Murphy and I had some weeks ago. The patient was an infant suffering with inspiratory stridor and dyspnea, which we at first attributed to an enlarged thymus, but in making a digital examination of the pharynx, before withdrawing the finger, I felt a cystic mass at the root of the tongue in front of the

epiglottis. It was evidently pushing the epiglottis over the larynx. We tried various methods of reaching the tumor, and finally by using the finger as a guide and pushing a forceps into the cyst, caused it to rupture, with disappearance of the symptoms. In this case the simplest technic worked better than anything else. But I think, as a general rule, one can accomplish more by the direct method in these cases.

Dr. J. C. Beck, Chicago: The doctor referred to a method by the external route which I followed several weeks ago. To-day, however, I would do the operation by the direct method. Now I want to point out that in cysts in the region of the epiglottis you must look out for cysts associated with the thyroglossal duct. Since the case reported by the doctor, I have had a number of thyroglossal duct cysts which had opened in the region of the epiglottis. If one is sure of destroying every vestige of epithelium by the direct or indirect method I think cauterization would be a good thing, yet I should not want to promise any patient a permanent cure from cautery that would not eventually involve the neighboring structures. From our knowledge of the pathology of cysts we know it is necessary to do that or else from the little vestige of epithelium a new cyst will form. Therefore, there is still room for a thorough eradication of cysts in this region, and I am not yet ready to give up the external method of dealing with them.

Dr. W. L. Ballenger, Chicago: I would suggest a much better instrument than the one shown by the essayist. It is the Mauritz Schnidt instrument, a modified tonsil punch. I have not used it, but have used the ordinary tonsil punch forceps; that is, the Reault punch forceps, by throwing the head backward and depressing the tongue.

Dr. H. Moulton, Ft. Smith, Ark., (closing discussion): In regard to the suggestion concerning the direct method, I found that the view was much more imperfect than I could get with the indirect method. The trouble was not in using it, but in getting an instrument of the right curve over the tongue. The man was short-necked and fat, and any right-angled forceps projected up into the roof of the mouth too much, and this Lowenberg forceps I had in mind. If I had not succeeded in changing the shape of one of these forceps a little I would have had one made just like this, with the curve of the handle down the other way. The question of getting instruments in the first place, and then a method of removing the whole thing is the main matter in these cysts, as Dr. Beck mentions. The question of using chemical caustics is not to be considered, although you could use them elsewhere. You would have no control over the chemical after it once left your instrument. Finding it impossible to get the whole cyst, the electrocautery was the only thing left, and by putting a large tip down into the cyst cavity, where I knew it was within the cyst, burning pretty thoroughly, I succeeded in destroying it. There has been positively no sign of recurrence of it within the eighteen months that have elapsed.

REFLEXES FROM ELONGATED UVULA

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It is very probable that there is but little in this paper which is not known to those of you who treat the throat, but as far as I know, laryngological literature contains very little on this subject for the guidance of those who have not specialized. This paper is therefore offered that it may bring out a valuable discussion on this important part of otolaryngology.

The uvula is a conical prolongation of the posterior border of the soft palate. It varies considerably in size under normal conditions. It is about a centimeter in length and hangs free in the oral cavity when the mouth is open and the organ relaxed; it should not touch the tongue. The uvula is a sack of mucous membrane containing bundles of muscular fibers — the azygos uvula. The azygos uvula is not a single muscle, but in most cases consists of two distinct bundles of muscle fiber which arise from the posterior nasal spine of the hard palate and from the contiguous aponeurosis of the soft palate, passing downward, and are inserted into the tip of the uvula. One part of the muscle fiber is voluntary and another is involuntary. Very few of the muscle fibers are striated. All of the muscle fibers seem to be composed of an outer membrane and an inner substance, closely resembling fibrin (Hoen). Occasionally the uvula is bifid. This condition is undoubtedly analogous to a congenital cleft of the soft palate or hair-lip. It is the mildest form of a cleft palate. Lennox-Brown of London reports a case of triple uvula — a central and functional efficient one, with one on either side, shorter prolongations without fibers.

The function of the uvula and soft palate is to close the nasopharynx during deglutition, and with the epiglottis assist in shutting off the buccal cavity during normal nasal respiration.

At first an elongated uvula merely lasts for a time, and by the use of astringents it disappears, but later on the elongation becomes chronic and causes great irritation of the back of the tongue and fauces, resulting in a troublesome throat cough and even vomiting. The cough is usually dry, irritating and persistent. The uvula cough, as it has been called, is peculiar, and may often

be recognized by its quick and ineffectual hack but not always. It occurs most often at night, or when the patient lies on his back. Often he wakes up suddenly with the sensation of being choked, even when he takes a nap on the sofa. Catarrh, relaxation, dyspepsia, want of tone, etc., are sure to aggravate the symptoms. The peculiarly troublesome cough sometimes gives rise to pain in the chest, and in long-standing cases many of the symptoms of tuberculosis may be assured. The exhaustion attendant on coughing often adds to the suspicion of pulmonary disease. Dr. Stokes declares he has seen all the symptoms of phthisis except physical signs produced. Further neglected conditions of this kind may even rouse up to activity pulmonary diseases, which had otherwise long remained latent. The cough may be distressing, and at times results in gagging and vomiting.

The most frequent sensation of an elongated uvula is a tickling sensation of the fauces. The patient may have a foreign body sensation in the throat as a result of this condition. In some cases the elongated uvula causes nausea and vomiting, the sensation of a foreign body moving in the pharynx and creating a continual desire to swallow. Singers experience a loss of vocal range, early fatigue and sometimes an annoying tremulo on the attempted production of any forced tone.

Respiration may be seriously obstructed in extreme cases, especially in the recumbent posture, or the dyspnea may be slight as the result of a reflex from an elongated uvula. Scheck states that elongation of the uvula may produce spasms of the glottis, especially in alcoholic subjects, and Mantle has described a case of laryngismus in a child cured by the removal of the uvula (Tilley). The reflex spasms of the larynx cause the suffocative paroxysms. The paroxysms of coughing in children from an elongated uvula may simulate whooping-cough. Reflexly asthma may result from a diseased or elongated uvula.

The etiology of elongated uvula is chronic pharyngitis, nasopharyngitis and want of general tone. Some authorities limit the term to the chronic relaxed uvula. The condition of an elongated uvula is sometimes congenital, consisting of a redundancy of apparently normal tissues. According to Bosworth, in most instances the elongated uvula is primarily congenital. It may result from relaxation attended with anemic symptoms, as the sequel of scarlet fever or diphtheria, from edema in conditions of debility, in profound anemia and in Bright's disease.

An elongated uvula occasionally occurs in children and very long ones may be observed in the aged. The uvula may reach even into the vestibule of the larynx or well down into the pharynx. If 2 inches or more long, the patient really swallows it. Kollock reported a case where the uvula had elongated to such an extent that it reached the upper incisor teeth, worm-like in appearance. In this case the symptoms were surprisingly few.

Partial paralysis occurs which gives it the appearance of an elongation of the uvula. Acute and chronic inflammation of the tissues of the upper air passages give rise to other forms of elongated uvula. The elongated uvula, together with the relaxation of the soft palate, is commonly associated with the various digestive disturbances classified under the heading of dyspepsia. Tumors or abscesses in the surrounding tissues may force the uvula downward and then the latter usually becomes edematous. Papilloma, cavernous angioma and epithelioma of the uvula may be mistaken for a simple elongation if the examining physician does not notice the uvula closely. A bifid uvula does not produce the reflexes unless it is elongated or inflamed.

"Singers and voice-users commonly ascribe any vocal defect to the uvula, but very often the trouble is due to a general relaxation of the soft palate in which the uvula takes part" (Tilley). "The constant presence of an abnormally long uvula not only temporarily impairs the singing voice but tends to give rise to morbid changes in the air-passages below under the influence of which not only does this impairment increase, but a serious danger of permanent loss is threatened" (Bosworth).

The normal uvula shows great variations in shape and size. The uvula that would be called elongated shows a greater variation. The elongated uvula is usually smooth, though the lateral borders may be corrugated. It generally hangs in the median line, though it is sometimes seen curled toward one side or the other; this no doubt is due to a paralysis of the azygos uvula on one side. When both sides are involved in the paralysis the uvula hangs down and simulates in an exaggerated degree the condition we have spoken of as elongation and relaxation.

It is important to recognize the part an elongated uvula plays in producing reflexes, in order to prevent errors in diagnosis. Physicians who never inspect the throat unless it is complained of may often be lulling fear in the midst of danger or exciting alarm without due cause, and in either instance losing reputation. If the uvula be elongated from an acute inflammatory attack, mild

astringent sprays or gargles of alum, tannin solution or adrenalin chlorid are sometimes sufficient to stop the reflexes — until the uvulitis has subsided.

If astringents fail to reduce the elongation or if a permanently elongated uvula is found on examination, amputation is necessary. As a routine practice the entire removal of the uvula is exceedingly unjustifiable and a vicious practice. If the elongated uvula is due to a malignant growth it is not only desirable to remove the growth but also the greater part of the soft palate.

A number of special scissors and uvulotomes have been devised for its amputation. In my own practice I simply seize the tip of the uvula with a pair of forceps and cut the redundant portion off with an ordinary pair of curved scissors. The uvula is first painted with a 10 per cent. solution of cocain; secondly, crystals of alypin are applied with a piece of moist cotton on the end of an applicator; thirdly, the uvula is painted with adrenalin solution; fourthly, the tip of the uvula is firmly grasped in the forceps and with the other hand I clip the elongated portion off with a pair of curved scissors, making the cut so that the raw surface runs backward and upward. My method is nearly the same as that of Ballenger.

Another method in use by many is to cut the uvula at right angles to the stump with scissors, knife or uvulatome. The objection to this and the cold-wire snare operation is that the raw surface is exposed to all that is swallowed, thus more frequently producing a sore and tender stump for a few days following the operation.

The Casselberry or Packard operation is as follows: 1. Ten per cent. cocain solution. 2. Seize tip of uvula with forceps and cut a wedge-shaped piece out of the uvula with a special uvulatome. 3. The remaining mucous membrane is sutured over the stump of muscular tissue.

The after-treatment consisted in advising the patient to swallow as little as possible the first twenty-four hours and to use soft food containing no salt, vinegar, pepper or other irritating substances. Bosworth advises his patients to carry a small piece of gum arabic or elm bark in the mouth, and for the children gumdrops or fresh marshmallows answer an equally good purpose. Keep the raw surface clean by means of warm gargles of normal salt solution or an alkaline antiseptic solution.

The following reflex cases are chosen from the numerous ones which have come to us for relief, with the idea of illustrating the different reflexes from the uvula.

CASE 1.—A., aged 16, schoolboy, came to me last February, complaining that he was compelled to frequently blow his nose, but was unable to blow anything out of it. On examination I found the septum slightly deflected to the right, normal turbinates, breathing space sufficient, pharynx and nasopharynx normal and uvula elongated. Finding no other cause for the reflex, I amputated the uvula. This completely relieved the patient and he has not had a return of the reflex symptom — the desire to blow his nose.

CASE 2.—B., aged 5. A year last August the parents of Miss B. brought her to me, saying that their child "hacks a good bit." She was emaciated, pale and weak, with a poor appetite, complaining of her stomach being tired and hurting. Her family physician had treated her for stomach trouble for some time without results. There were no enlarged tonsils or adenoids; the patient had free nasal breathing. The uvula was long and dragging on the tongue. I believed what was thought to be stomach trouble was due to the spasmodic contraction of the diaphragm — a reflex from an elongated uvula. Amputation of the uvula confirmed this opinion, as the hacking ceased, the hurting and tired feeling in the stomach disappeared, and the child's appetite picked up and she increased rapidly in weight and the color returned to her cheeks.

CASE 3.—Mr. H., aged 44, came to me complaining that his voice became husky at times, especially when he is troubled the most with a tickling sensation in the throat, and cough. On examination I found a bifid uvula with left side longer than the right, tonsillar crypts on both sides and laryngeal engorgement. Treatment was amputation of the uvula and removal of the tonsillar crypts, with the result that there has been no cough or huskiness of the voice since.

CASE 4.—E., aged 30, was brought to me by his family physician, Dr. W., with a history of severe attacks of coughing of about six weeks' duration, which frequently ended in vomiting. He had been getting temporary relief from cough medicine which his physician had prescribed. On examination I found a pharyngitis, a slight laryngitis and a swollen and elongated uvula. Amputation of the uvula lessened the severity of the cough and entirely relieved the reflex of vomiting. Examination of sputum showed tuberculosis bacilli. Dr. W. said repeated examination of the lungs showed no lesions. I advised the patient to go to New Mexico, where he could have fresh air, sunshine, and to take good, nourishing food. He remained in New Mexico six months and when he returned home we were surprised to find that his cough and tuberculosis bacilli had entirely disappeared.

CASE 5.—Mrs. G., aged 33, a very interesting case, came under my observation with an elongated uvula which gave rise to repeated paroxysms of asthma, accompanied with sibilant and sonorous bronchial râles. The amputation of her uvula gave complete relief

and she has not had a return of the asthma, plainly a reflex from her elongated uvula.

CASE 6.—Miss M., aged 23, came to me complaining of neuralgia in the left ear and a slight tickling in the throat. On examination I found her ears, teeth, nose, pharynx and nasopharynx normal, but a slightly elongated hard, fibrous uvula. Uvulotomy removed the cause of the neuralgic pain in the ear and the tickling in the throat without further treatment.

CASE 7.—R., stenographer, aged 33, came to me for treatment, stating that she had to place her finger against the side of her nose to blow it every few minutes but was unable to blow anything out of it. She said that the blowing made an obnoxious noise to all her associates, this greatly embarrassing her. Inspection of the nose and throat revealed nothing abnormal except an elongated uvula which was deflected to the right side, lodging against the pillars. Since uvulotomy was performed several months ago, the annoying reflex has not returned.

CASE 8.—Dr. S., aged 43, came to me last February from Kansas City, complaining of a distressing cough and "crickets" in his ears of about three months' duration. On examination I found the mucous membrane of the nasopharynx engorged, especially in the fossa of Rosenmuller, a few tonsillar crypts, and an elongated uvula. The reflex cough and noises (crickets) in the ears ceased after the amputation of the uvula.

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DISCUSSION

DR. J. H. JOHNSON, Coffeyville, Kan.: I was in hopes that this paper would bring out a fuller discussion of the subject. This was my object in writing on this subject—that we might learn something more about the uvula reflexes. The doctor speaks of the lingual tonsil getting in the way, causing a tickling and cough. The lingual tonsil sometimes does get in the way. We may also have a lingual varix at this same point, an enlargement of the veins in and around and anterior to this lingual tonsil. I have studied the lingual tonsil and varix closely, but neither of them entered into the production of the reflexes in the cases reported.

CHRONIC PERITONSILLAR ABSCESS

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In considering this subject, three questions present themselves at once for an answer:

First. How rare is this condition in the practice of operators of large experience?

Second. Is it a distinct disease process, differing both in character and severity from the acute infection of this region, or is it an aftermath of the acute type?

Third. What is its influence on the general health?

In order to fortify my own meager experience, I first consulted the text-books and medical literature on the subject. Careful review of articles in the Index Medicus of the *Laryngoscope* since its birth, together with the monthly review (*Oto-Laryngology*), published by Beck, failed to disclose a single article on the subject.

I then sent a letter of inquiry to fifty men in various parts of the country, selecting men of large experience and asking them the following questions:

1. How many such cases have you encountered?
2. What were the local symptoms, if any?
3. What were the constitutional symptoms, if any?
4. What was the effect on the general health?
5. What was the result following the operation?
6. Did anything lead you to suspect the condition previous to operation, or was the condition uncovered by chance at the time?

Unfortunately, a goodly number were away on their vacations, so I received but twenty-four replies. Of these, ten had no knowledge of the condition and had not encountered a single case.

For instance, Dr. Linn Emerson of Orange, N. J., writes: "I do not recall having such a case."

Dr. Sidney Yankauer of New York City writes: "I have never met with such cases in my own practice, and know of only one or two in the experience of my colleagues."

Dr. George L. Richards of Fall River, Mass., writes: "I do not think I have seen such cases as you describe. I assume you

are not referring to the occasional presence of encysted pus in the tonsil, but to a true peritonsillar abscess without symptoms."

Among the fourteen who replied to my letter in the affirmative, there were two different groups. Five gentlemen had encountered such cases in large numbers, one having seen as many as eighty cases and the others forty or more. In the nine remaining replies, the number ranged from one to six cases. Whether the discrepancy in these two classes was caused by my not making myself clear as to the class of cases I was talking about or whether it was due to a misconception on the part of the one answering, I cannot say. It is interesting to note that the extremes of experiences, one case and eighty cases, came from men in the same city. Judging from the replies I received it is certain that these observers had a very definite idea of the cases concerning which I desired information.

Dr. J. A. Stucky of Lexington, Ky., writes, in answer to the first question: "I would say probably I have had between twenty-five and thirty cases, not more than four or five of these presenting any local symptoms. The constitutional symptoms were those of toxemia or sepsis. The effect on the general health was to make them neurasthenic. The result following the operation and keeping them on a restricted diet for several months was most gratifying."

Dr. Ruben J. Held of New York City writes: "Probably during the past three years fifty, of which half were discovered at operation."

Dr. F. Pfister of Milwaukee writes having had between fifty and eighty — mostly found in looking for seat of pain and irritation.

Dr. Charles M. Robinson of Chicago wrote me a very interesting letter on the subject, which I quote in part: "I have seen a number of cases of latent peritonsillar abscess during my practice. Just how many I cannot tell, but it is not an uncommon occurrence. The symptoms are the same as we have in chronic cryptic tonsillitis. Most of these cases were found in operations for the removal of caseous tonsils of the submerged type. The collection of pus has been above, behind and external to the gland. It has varied in amount from a few drops to a teaspoonful. It has oozed out about the scissors or fixation forceps and in numerous cases has squirted across the pharynx in being ruptured by the scissors or fixation forceps. In one case the accumulation ruptured into the larynx, almost causing the death of the patient. The infections are never sterile. They are most frequently pneu-

mococcus infections. I think I was the first one to bring this before the medical profession, but fail to note any credit having been given for it."

Of the other group, Dr. William E. Casselberry reports two recent cases without stopping to go through records.

Dr. Dunbar Roy of Atlanta reports two cases.

Dr. George F. Cott of Buffalo writes: "I recollect two within the last year. Rather rare."

Joseph Beck, Chicago, reports three cases; F. P. Calhoun, Atlanta, Ga., four cases; Justus Matthews, Rochester, Minn., three cases; J. W. Murphy, Cincinnati, six cases; J. L. Davis, Philadelphia, ten cases.

Dr. Henry Hitz of Milwaukee reports one case seen a number of years ago in a child 13 years old. Patient had a swelling in the upper tonsillar region which slowly progressed and was mistaken by the physician in charge for a sarcoma. Evacuation of the pus relieved the symptoms and the patient was entirely restored to health.

The first case of this type that I observed was the hardest to diagnose and probably the most interesting as indicative of what a profound depression of the general health such a condition may induce.

Case 1.—V. P., aged 17, was seen Oct. 19, 1908. Patient was a delicate and anemic boy working as a clerk. He got no exercise and was very nervous. He had had a cough for several years which was worse in the winter. Three weeks ago he contracted a cold, which has persisted. He had been conscious of fever for several days, at times chills, and profuse sweating at night.

An examination showed an open nose through which he could breathe at all times, and no nasal discharge. While he reported some expectoration and tickling in throat, there was no evidence of inflammation or swelling: tonsils were rather large and boggy, but partook of the general appearance of the mucous membrane, which was pale. The record of pulse and temperature was not preserved.

Three days after the first visit I was called to the house. The patient had had a typical chill, fever and sweat which had put him to bed. The house in which the family lived was on low ground and had water in the cellar, which made us suspicious of malaria, though blood-slide failed to reveal the plasmodium.

Energetic treatment with quinin and tonics, however, improved the condition, though the boy did not gain greatly in health and strength. It was thought, both by his family and employers, that he was a subject of tuberculosis. He had evening temperature

and all of the general symptoms of a serious systemic infection. No evidence was discovered in the lungs, however.

December 4, after advising with his parents, we decided to remove the tonsils in the hope that this would relieve a portion of the infective process with which we were certain he was affected. This was done at the office under local anesthesia, both tonsils being removed. There was a collection of pus above and behind both tonsils which escaped on freeing the supratonsillar portion, about 1 dram in amount. No microscopic examination was made of this pus, as it escaped before a specimen could be obtained.

Following the recovery from this operation the boy's health greatly improved and he was urged to begin regular exercise. This he did at the Y. M. C. A. and gaining rapidly in strength and health was able several years after that to be the second man in the annual exhibition.

Case 2.—N. W., aged 13, was seen Sept. 3, 1910. The patient had had trouble in his nose and throat for several years. The adenoids were removed several years ago, with but partial relief. Has never been robust or very healthy. The appendix was removed, which was suspected of being tuberculous. While recovery from this operation was complete, he did not gain in either health or strength.

Examination showed the presence of large boggy tonsils without distinctive swelling or redness, and the patient localized no particular symptoms in his throat at the time of the examination. There were remnants of adenoids in the nasopharynx.

The case was given the usual preparation and the tonsils removed under local anesthesia at St. Anthony's Hospital. An abscess escaped from behind the left tonsil on dissecting it out, containing 1 or 2 drams of pus. His adenoids were removed later.

This case likewise greatly improved following the operation and as in Case 1 there were no localized symptoms which would serve to indicate that an infective process was encapsulated behind the tonsil. It is worthy of remark that the cavity which remained following the evacuation of this abscess had smooth, tough, bluish-red-looking walls which satisfied me that it had been present for some time at least.

The three following cases are reported, not as examples similar to the first two but rather to show the tendency of these cases to become chronic. In other words, I believe that had these cases been a little less severe or the patients a little less sensitive these infections might have become similar to the first two.

Case 3.—H. N., foreman in large foundry, was seen Dec. 29, 1910. General health was good. No previous history referable to the throat. He was taken sick two weeks previously with acute tonsillitis, his first attack, and only partially recovered, with persistence of symptoms on right side. This he described

as a peculiar boring pain or ache sometimes referred to the ear and distinctly worse at night when he lies down. No alteration in voice or such other symptoms usually referable to acute peritonsillar infection. After several days' treatment without influencing the condition, the peritonsillar region was freely incised, disclosing a large quantity of fetid pus.

The interesting feature of this case was the number of infections which occurred following this. He was advised to have his tonsils removed but refused. On February 15 he returned with the second infection of the peritonsillar region on the right side, which was opened and drained; this was followed February 21 by an abscess on the left side which was opened and drained. It was not difficult now to convince him that his tonsils ought to be removed, which I did on March 3 and 17 under local anesthesia, taking one tonsil at a time. The patient made a complete recovery and has had no further trouble.

Case 4.—Miss M. K. was seen March 3, 1912. The patient gave a previous history of tonsillitis, which was treated by the family doctor with but partial recovery. She was referred to me by the same physician for an explanation of the persistent symptoms on the right side, which consisted chiefly of pains at night and in morning immediately after arising. They seem to be slowly increasing in severity. There were none of the usual local or constitutional symptoms of peritonsillar infection, though an examination disclosed a rather pronounced swelling over the upper portion of the tonsil. This was incised and a large quantity of pus liberated. The patient's recovery was complete with no recurrence to date.

Case 5.—R. McC. was seen May 15, 1913. Had an attack of acute tonsillitis followed by persistence of symptoms on right side. Was referred by the family physician for explanation of the same. He complained chiefly of pain or ache deep and boring in character, worse at night; sometimes referred to ear.

An examination showed a very much enlarged, red tonsil on the right side with slight edema of soft palate. Incised under local anesthesia, a moderate quantity of purulent material was evacuated.

All these cases just described are distinctly cases of pus behind the tonsil and are in no sense examples of purulent collections within the crypts or tonsillar substance itself that we often see squeezed out when grasping the gland with a volsellum.

In the two most chronic cases, the abscess cavity as seen after the removal of the gland, showed smooth, thickened, bluish-red walls, and a purulent collection thoroughly localized and protected.

The latter cases are not altogether in the same category as the first two, inasmuch as the history of an acute inflammation was obtainable, and are reported to show the probability at least that

such cases as the first two are but gradations in severity from the acute type, an end process as it were, and are in no sense a separate and distinct disease process.

From the results in the cases reported, together with the experience of the operators I have questioned on the subject, I deduce the answer to the three questions raised in the opening paragraph; first, that comparatively speaking these cases are rare; second, that it is not a distinct disease process but a modification of the acute infection; third, that the effect on the general health may at times be profound.

The process constantly exhibits general symptoms usual with hidden pus, the local symptoms varying greatly. The effect of its evacuation is, of course, good, the patients sometimes gaining health and strength to a remarkable degree.

DISCUSSION

Dr. H. L. Pollock, Chicago: These cases are unusually rare in my experience. I have had two cases which were discovered accidentally; that is, that were in the first class of cases, which the doctor reported, while in the other class, of course, we find them more frequently. Yet the second class I should say is a subacute peritonsillar abscess rather than a chronic one, because often these cases come with very few symptoms.

Just recently, I had a case that could be classified under the subacute type, which was of about ten days' standing and the patient came with the diagnosis made, but no symptoms to speak of. At the time I saw him first, he had no temperature nor pain, but there was a swelling in the posterior pillar and some salivation or dribbling of the saliva. I incised the posterior pillar and obtained a small amount of pus, which proved to be a pneumococcus infection.

It is rather unfortunate the doctor was not able to give the bacterial findings in these cases, because this is important. In a case just previous to the above, the patient came with a history of peritonsillar abscess and all the clinical symptoms. One attempt had been made by some one else to open this abscess. This was probably from ten days to two weeks following the attack. The patient recovered without any abscess and a tonsillectomy was performed just three days after this time. A radical enucleation was done on both sides, and no pus discovered at that time. The patient made an uneventful recovery. I saw one case of the real chronic type in which there was a few drops of pus, but gave no local symptoms of any kind; only those symptoms associated with a chronic peritonsillar infection. That is about as far as my experience goes. I have seen several cases of subacute peritonsillar abscess, some of which, as we know, will clear up without evacuation of the pus, and these are probably the cases in which the abscess becomes encapsulated without much absorption. I can understand that some of these cases, caused by a mild organism, might have no local effects manifested. It would be interesting to know just what organism is the cause of the real chronic cases.

Dr. M. W. Cullom, Nashville, Tenn.: I am surprised to learn that a great many men had not found this condition in the course of operating.

I have encountered it a number of times. I recall two cases on successive days: One patient, a boy of 15 years, was referred to me by his physician on account of a serious heart lesion which he attributed to tonsillar infection. The boy was operated on under general anesthesia and when I snared off the right tonsil a collection of foul pus was found outside the capsule with a sinus extending through the constrictor muscle.

The other patient consulted me in regard to chronic recurrent tonsillitis. Before undergoing operation, his general condition was passed on by two physicians who independently found a heart lesion. When I had dissected up the right tonsil, I thought that a piece of cotton had inadvertently become lodged on the tonsil. On examination I found that I had broken into a large abscess. I remember another case which I operated on in conjunction with a general surgeon. The patient had a broken-down gland in the neck. The surgeon removed the gland and I enucleated the tonsils and we found there quite a collection of pus.

One is likely to find this condition among the cases referred by the internist on account of constitutional trouble. The appearance of the tonsil often gives no indication of the presence of pus. These are the cases which give rise to systemic infections, heart lesions, kidney lesions, arthritis, etc.

Dr. Kate Baldwin, Philadelphia: I have one case which I think might be classed as the end-result of this condition. A woman, past 40, who for a number of years had had repeated sore throats with toxemic symptoms and the tonsils more or less involved, had been treated for a number of years by a thorough physician. It was deemed advisable to remove the tonsils. As I removed the tonsils, back of them I found a large mass of inspissated pus, in the left tonsil fully a drachm, and less in the right. After this her general condition improved decidedly. I think the operation was done five years ago.

Dr. C. S. Means, Columbus, Ohio: I remember having three cases of this kind in the last two years. In the first case I thought I had a beginning quinsy, when I evacuated a pus sac and gave it little thought.

Case 2.—A little girl came to me in the early part of this year, anemic, nervous and unable to go to school. She had small submerged tonsils and no adenoids. I told the mother the child had better consult an internist for examination and receive a general tonic treatment. After about four months the mother brought the child back to me again. She had a chronic cough and as the physician said "there was no trouble with the lungs," I advised removal of the tonsils. After seizing the tonsil and making traction, my first incision opened into a large abscess, evacuating more than a dram of creamy pus. As I got a good deal of hemorrhage with the first incision, which was unusual, my attention was so taken with it that a specimen of the pus was not obtained. The abscess extended almost the entire length of the tonsil. The child's improvement was very rapid and marked. She soon recovered sufficiently to return to her school work.

Case 3.—That of a young boy 7 years old, with not seemingly very badly diseased tonsils, nor very greatly hypertrophied, but his general health way below par. I advised removal of the tonsils, suspecting his poor physical condition might be due to, his absorbing toxines through this route. On removal, a small abscess was found beneath the tonsil, inside the capsule. As in Case 2, he made rapid recovery, together with great improvement in his general health.

Dr. W. H. Roberts, Pasadena, Cal.: It seems to me the essayist has described two typically different types of infection in his paper, and

consequently the title is misleading. While infection in the tonsil has occurred in both classes of cases, the subsequent progress has been different. I do not regard a case as one of peritonsillar abscess when, on operation, pus is found behind the tonsil but within the fossa. In such a case the infection occurred in the tonsil, and the pus ruptured through the capsule and invaded the tonsillar fossa.

The second class of cases I regard, as did one of the gentlemen who discussed the paper, as a subacute peritonsillitis. Undoubtedly that was originally a peritonsillar abscess which had undergone partial absorption, and this I regard as a subacute peritonsillitis, rather than a chronic condition.

Dr. J. A. Stucky, Lexington: Dr. Roberts made the point I wanted to emphasize, and that is the danger of our mistaking broken down inspissated pus, that Dr. Baldwin referred to, for a peritonsillar abscess. If the abscess occurs between the tonsil and the tonsillar sheath, it is not peritonsillar. All the peritonsillar abscesses I have seen, that is the chronic ones, have been in cases which previously had a peritonsillitis, in which the abscess was opened through the soft palate; and I believe that the secondary abscess was the result of imperfect drainage. For this reason some years ago, at the meeting of the Mississippi Valley Medical Association at Nashville, I brought out the point that a peritonsillar abscess ought to be opened at the junction of the anterior and posterior pillars; then, whenever the patient swallows, the act of swallowing helps to drain that cavity, but where you evacuate between the angle of the jaw and the uvula you do not get good drainage. I think we often make the mistake of diagnosing a peritonsillar abscess when it is retained secretion between the tonsil itself and the capsule or within the tonsillar crypts; this is not a peritonsillar abscess; it is the pus which forms back of the capsule in the peritonsillar tissue that constitutes a peritonsillar abscess. The worst case I have ever seen has been where I could find no tonsillar tissue whatever.

Dr. Joseph C. Beck, Chicago: The discussion has brought out practically what I wanted to point out, and that is the rarity with which this condition is found by some and the frequency with which it is found by others must be due to a mistake in the interpretation of what has been seen. I have met with only one case. It was my pleasure to entertain Dr. Sluder in Chicago, and I selected for him the worst case I could possibly find for operation. The patient had a very red throat and was irritable, but the patient stood the ordeal well under local anesthesia. On Dr. Sluder's first attempt he got no tonsil, and on the second attempt it was the same thing. The point I want to make is that difficulty in operating ought to suggest a peritonsillar infection going on. My idea is, have you proved that your tonsil is out? Have you passed the probe and found the capsule, or having taken out the tonsil, have you found one of these deep-seated pockets with pus in it? You will find chronic peritonsillar abscess very rare.

Dr. J. J. Johnson, Coffeyville, Kan.: I remember a case which came to me with an abscess, back of the right tonsil, though the patient complained only of his left tonsil. He had been having trouble with cheesy masses coming out of the tonsil and a foul breath. I removed this tonsil. On observation the right tonsil did not show anything abnormal except an adherent anterior pillar. He had had no symptoms or trouble on the right side. In separating the anterior pillar from the small contracted tonsil, about 1 dram or 1½ drams of creamy white pus came out. I

removed what was left of the tonsil, though the patient gave a history of having had absolutely no symptoms on the right side.

DR. WILLIAM R. MURRAY, Minneapolis: I agree with two of the speakers who have preceded me that there is probably a misunderstanding as to the cases under discussion. I have no doubt that many cases reported and referred to as chronic peritonsillar abscess are a liberation of pus between the capsule and tonsil during the operation. Diagnosis is always made at the operation. I think when our attention is called to this condition we can all recall having seen a considerable number of cases where there has been an escape of pus at the time of operation. I think we would be inclined to consider the pus as coming from an accumulation of pus outside the tonsil fossa and yet it is not a case of peritonsillar abscess.

I do recall one case which came under my observation not long ago in which the diagnosis was easily made before operation. This young lady gave a history of repeated attacks of tonsillitis. When she came to me there were no signs of acute inflammation, but there was a fulness above the tonsil with a discharging fistula through the upper outer portion of the anterior pillar, and a probe could be passed above and back of the tonsil. The operation for removal of the tonsil showed an accumulation of pus. That is the only case I can recall having seen in which there was an undoubted collection of pus which could be considered a chronic peritonsillar abscess.

DR. W. L. SIMPSON, Memphis, Tenn.: It seems to me that I have seen from ten to fifteen cases which would come under this title. I have certainly seen that many cases at the time of operation. After fixing the tonsil with the forceps, I insert the separating scissors between the tonsil and the anterior pillar external to the capsule; and just at this time I usually see this pus exuding, about 1 dram in amount. I have seen this condition more often in cases which have had no acute peritonsillar abscess; but to my mind this pocket of pus was entirely outside the capsule, not having anything to do with the tonsil proper. These cases occurred usually in children where there had been no attack of follicular tonsilitis and where there had been no symptoms whatever, and was found only at the time of operation.

DR. E. C. ELLETT, Memphis, Tenn.: Dr. Simpson speaks of going in with the scissors behind the anterior pillar and outside the capsule of the tonsil and finding pus. It seems to me that is what a peritonsillar abscess is—a collection of pus outside the capsule, but still inside the fossa. That is the space I go into, by the method which Dr. Stucky described so long ago, and which I have been following ever since.

DR. H. G. LANGWORTHY, Dubuque, Iowa: One point I would like to bring out in this discussion and that is our taking the other viewpoint of the situation. We certainly never get a supratonsillar abscess unless there is some tonsillar tissue present obstructing the drainage. Therefore, it would seem to me we ought to be pretty slow in describing some of these strangely acting, so-called chronic peritonsillar inflammations, as worthy of a special nomenclature or as going any great distance from the tonsil. I regard these chronic, or rather subacute cases, as being merely an inflammation of the tonsil with pus in the fossa somewhere which had never been thoroughly drained from the region; hence resolution was greatly protracted.

DR. C. C. HALL, Louisville, (closing discussion): I want to thank you for the generous discussion. Now let us consider first the question as

to what class of cases these are. It seems to me the distinction made is purely of academic interest. If you premise that the cases of peritonsillar abscess are only those in which a previous infection has occurred and had insufficient drainage, that would necessarily limit this application materially. I maintain that a peritonsillar abscess is a collection of pus behind the tonsil external to the capsule, and between that and the fascia which overlies the structure of the muscle.

I want to thank a number of the speakers for bringing out the association of toxic conditions of the tonsil with rheumatism, heart and kidney lesions. In regard to the possibility of these collections of pus being within the tonsillar substance, I want to say that in my experience the tonsils which have been presented for removal were not big enough to hold a dram of pus, and consequently it must have been behind the tonsil. Finally, the three cases reported last were not reported as examples similar to the first two, but merely to substantiate a theory in my own mind that these last three cases showed a transition period which if continued would result in cases similar to the ones I first reported.

EPITHELIOMA OF THE EXTERNAL EAR

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I have chosen to investigate the subject of epithelioma of the external ear exclusive of the middle ear because the latter is always fatal and is usually secondary to epithelioma of the canal or auricle and hence middle-ear cancer is of rather academic interest.

Some idea of the infrequency of epithelioma of the external ear may be gained from the following:

West[1] states that in ten years at the London Hospital there were thirty cases of malignant diseases of the pinna among 200,000 patients a year. In the last two years at St. Bartholomew's Hospital there were seven cases. McBride[2] reports having seen but three cases in twenty years' practice. There were two epitheliomas of the pinna in ten years at the Liverpool Eye and Ear Hospital. Accordingly, it may not be amiss to record the twenty-seven cases observed in the Mayo Clinic from Dec. 31, 1907, to Oct. 31, 1913. In addition to this, I have collected twenty-two cases more or less completely reported in the journals. The data on our cases are fairly complete with the exception of the final results which, in some cases, are in doubt either because the patients did not reply to letters sent them or because a long enough time has not elapsed since they were dismissed, apparently cured. Most of the cases in the literature examined are incompletely reported, especially as regards prognosis. No cases were considered where a report of the microscopic findings was lacking.

Anatomically there are several features of the external ear which bear on the subject. The pinna is prominent enough to be the object of fairly frequent injury The auriculo-mastoid furrow is frequently irritated by eczema and the bows of spectacles. The canal, concha and lobes are exposed to the irritating discharges of middle-ear suppuration. In addition, the canal is exposed to hardened wax and much manipulation. The skin of the external ear is well supplied with large sebaceous follicles, the origin of all rodent ulcers, according to Bland-Sutton.[3] Underlying the skin closely is the cartilage which forms a barrier to the spread of

1. West: Proc. Roy. Soc. Med., 1908-9, ii, Otol. Sect., pp. 34, 87.
2. McBride.
3. Bland-Sutton.

epitheliomata as well as a protection to them, once the cartilage is invaded.

The lymphatic-drains are divided into three groups:

1. The posterior group, draining part of the external surface of the pinna, all of the internal surface and the posterior walls of the external auditory canal.

2. Inferior group, draining lobule and adjacent parts of pinna and inferior wall of external auditory canal.

3. Anterior group, draining trunks from the anterior part of the external auditory canal and concha leading to the parotid glands and a node in front of the tragus.

The average age of incidence was 62 years; of these patients, the youngest was 46. The youngest age I find reported was a case of epithelioma of the canal in a boy of 18. Males greatly predominate — 74 per cent. of our cases to 85 per cent. in the literature. This is probably due to the greater exposure to injury of weather and trauma in the male.

In 71 per cent. of our cases the epitheliomas were primary in the pinna, though several had spread to the canal when seen. No point of origin greatly predominated, though the auriculo-mastoid fold and the region of the meatus were perhaps the more common.

As regards etiology, it happens that none of the epitheliomas of the canal were caused by chronic suppuration, though writers generally give this cause the most prominent place. Two of our cases had a preceding eczema of the canal and one a history of hardened wax. Two had a history of furunculosis of the canal which was found to be cancer on microscopic examination. Of those primary in the pinna, injury was the most prominent cause given. Eczema of the auricular mastoid furrow and what seemed to be sebaceous cysts were also common. In most of the cases the skin was of the type which seems ready to blossom forth into cancer on slight provocation. Often small areas of keratosis were found about the face and neck — the so-called "sailor's skin," most often seen in people of blonde complexion who burn easily in the sun and wind.

These epitheliomas may be divided into the squamous-celled variety originating in the corium and the rodent ulcer or basal cell originating in the sebaceous follicles. Pathologically, these distinctions are not clear-cut. All of these tumors show cells of both the squamous and basal-cell type, and the difference seems to be chiefly a clinical one, especially in late cases. The origin of

rodent ulcers in sebaceous follicles is questioned by many patholo gists. The somewhat artificial distinction, however, I think unnecessary in this region. Clinically, the squamous-cell type predominated slightly in this series, that is, those starting as scales and keratosis, though the progress was practically the same. This is also true of the cases reported in the literature, the squamous type considerably predominating. Nearly all were of slow growth, the average duration before coming to examination being six months, though cases of four and twelve years' standing were not uncommon. One case was said to be of twenty-three years' standing, and Braislin[4] mentions two cases of thirty-five years' standing.

In spite of the long duration, glandular involvement was found in but four cases. A larger percentage (40) was found in the literature. The cases here were all of the cervical glands, the general experience being that the preauricular and the cervical glands are most commonly involved, simply shadowing the location of the growth. Of those having glandular involvement, the average duration before coming to examination was four years. Three-fourths of this group were primary in the pinna, both in our series and in the literature studied. None of these cases was classified as rodent ulcer.

Diagnosis.—This is usually obvious enough but, nevertheless, the number of mistakes made clinically is rather striking. Two of our cases were called furunculosis of the canal until the progress of the disease and the age of the patient suggested the necessity of microscopic examination. In the literature, I find many cases mistakenly called granuloma of the canal which later proved malignant. Beginning "rodent ulcers" before they became ulcerative were often called warts or sebaceous cysts until the growth aroused suspicion. Chancres, gummata and lupus are usually given as likely to simulate cancer; in practice, this differentiation has not proved difficult. It is always easy to excise specimens for examination, but in the superficial indolent growths of small size where radium or simple actual cautery may well be used, treatment should follow immediately the taking of a specimen rather than allow the stimulated tumor to grow. Pain is often quite a prominent symptom in canal cases; it is more severe than in ordinary furunculosis or suppuration in the middle ear. Many cancers gave rise to a discharge of blood and fetid matter where no middle-ear suppuration was present. Chronic canal disease, in people over 60 years of age, should always be examined with malignancy in

4. Braislin: Ann. Otol., Rhinol and Laryngol., 1907, xvi, pp. 90-98.

mind. Primary cancer of the pinna was not found to occur in young people. It may, however, occur in the canal of young patients because of the irritation of middle-ear suppuration. It must be emphasized, however, that in cases of doubt, microscopic examination should never be omitted, for on this, after all, the diagnosis must rest.

Recurrences.—I find the data in the literature very meager on this subject. Of the few cases in which specific mention of this is made, three-fourths did not recur after operation (of the cases without glandular involvement). Of the present series (considering only those without glandular involvement), over 58 per cent. recurred. Most of these recurrences were small nodules at the site of operation and easily cauterized away. In no case were there recurrences in the glands, where these were not involved previously. The average time of recurrence is two months, four months being the longest. Figures as to the recurrence and non-recurrence (and in this connection only the cases definitely heard from since operation are considered) are fallacious because they depend on the various causes which determine whether our letters are answered or not. Considering, in addition to the ones who answered or were seen some time after operation, those whose prognosis was registered in the histories as "not likely to recur" (this based on the superficial character of the growth or the clinical course under observation), 50 per cent. did not recur at any time. Note that this does not refer to final cures. Of the cases which did recur, it is noticeable that all were adherent to the cartilage; all were primary of the pinna, this last probably depending on the greater tendency of rodent ulcer to attack the pinna. There is no doubt that the thoroughness of the operation performed is a most important factor, granting that the case is legitimately operable. In many cases the operation was doubtless less radical than it might have been, because of the desire to do as little mutilation as possible, the feeling being that if the patient can be watched, a small nodule or two may be easily removed.

Treatment.—Actual cautery or radical local excision and cautery has been the treatment followed in most of these cases. It is in general by far the most effective treatment for epitheliomas in this region. I cannot find enough accurate data in the literature to make a statistical comparison between this method of treatment and simple excision, radium, pastes or Roentgen ray. Few patients come to us without a history of treatment with ointments, pastes

or Roentgen ray. Still, there is no doubt that pastes persisted in and skilfully used are effective in selected cases, as witnessed by one case of excision and cautery in our clinic which recurred, but was elsewhere cured by a paste treatment which also removed the whole of the external ear and part of the face. The objection to sarcophagic paste lies not so much in the method but in its terrible abuse by all manner of quacks who do not dare attempt anything surgical and jump at this means of keeping the patient among their sources of revenue.

The Roentgen ray, while undoubtedly occasionally successful, is not to be depended on and should not be used save as an after-treatment unless the patient can be under close supervision until cured. Its use is best confined to superficial, slow-growing epitheliomata.

In our hands, radium has been more effective on the whole than the Roentgen ray; its use should be confined to the same class of cases. In adherent or deeply seated growths, however, it is ineffective and, like all ineffective methods in the treatment of cancer, by causing a loss of valuable time, may prove a menace to the patient's life. Radium has the great advantage of leaving no scar, there is practically no danger of burning and it is pleasant to the patient. Unfortunately, its action is slow and usually the patient must be under observation and treatment for a long time.

Granted an accessible growth, actual cautery or excision and cautery would seldom fail if the surgeon did not have cosmetic results in mind. In practice, it is not infrequently necessary to cauterize small recurrences at the site of the previous operation. These are usually small if the patient is warned to return for treatment at the first sign of a new growth. Superficial growths of small extent need simply to be cauterized and, for this purpose, the electric cautery or the Paquelin answer very well. Larger or adherent growths are better excised, cutting well into the sound tissue and burning the entire wound with the soldering iron. The wound is packed with boric-acid powder and bandaged. In cancers involving the canal to any extent this is more difficult and involves in some cases an occlusion of the canal. In most cases grafting is not necessary, since the scar is apt to be surprisingly good cosmetically and the patients have arrived at an age when some scar is preferable to the inconvenience of a graft. The cauterized tissue, however, sloughs off easily and furnishes a good bed for graft in a couple of weeks.

Radical local excision without cautery is permissible in non-adherent growths so circumscribed that there is no question of the whole growth being removed. The element of safety in the cautery lies, not only in the killing of any seed-cells that may have remained in the wound, but also in the deep cooking given the tissue beyond the reach of the knife. This is seen especially in growths adherent to bone or cartilage. What statistical data I have been able to collect support the use of cautery in addition to excision.

Prognosis.—We have completed records of two cases with glandular involvement operated on. One of these should be classed as exploratory, because the exploration showed such extensive involvement of the middle ear and mastoid that further work was abandoned. The one cured had radical removal of glands and is still healed after seven months. Of the completed cases in the literature, three died and two were cured (time given in one case only, eleven months). It should be mentioned that of the three patients who died, only one had a radical removal of glands, whereas both those cured had the glands excised as well as the growth. Small as these figures are, they offer very good justification for operation in cases with glandular involvement.

Of the cases without glandular involvement, two-thirds were cured; in the literature 50 per cent. Judging from the character of our cases not heard from or seen subsequent to operation, I should put the percentage of recovery considerably higher. Of those that were not cured, all growths were adherent to the cartilage. It should be emphasized here that percentages given are not to be regarded as absolute, since the number of completed cases is too small; they were computed merely to serve as indicators. All percentages are futile in the presence of the individual patient. Conditions unfavorable to cure are adherence, actively growing type and wide spread of involved area. Mere duration is of itself of little importance save that long duration before consultation usually means a very inactive type of growth.

CONCLUSIONS

1. Epitheliomas of the external ear are peculiarly resistant to treatment, and hence should be treated early and the patient kept under observation for at least six months.

2. The best method of treatment is radical local excision and actual cautery. Because of the infrequency of glandular involvement, dissection of glands should not be done routinely. Glandular

involvement does not render the case inoperable if competent surgical service is at hand.

3. Radium and the Roentgen ray should be reserved for small, superficial, slow-growing epitheliomas. The actual cautery is as effective in such cases and saves much valuable time. Caustic pastes, very effective in skilled hands, are so closely associated with cancer quacks that it would seem desirable not to lead the people to have confidence in them.

4. Chronic suppuration of the middle ear acquires an additional menace from its relation to cancer.

5. Radium entirely ineffective in adherent growths and all cases recovering after excision and cautery were adherent.

DISCUSSION

DR. J. M. RAY, Louisville: Dr. Fisher's paper calls my attention to a case of interest, seen only last week. A case of epithelioma of about twenty years' standing, which started as a small pimple at the base of the antitragus, was treated by a cancer doctor with paste and apparently cured; recurrence, reapplication of the paste and cured for a number of years and again a recurrence. At the present time there is quite an extensive ulcer that has destroyed the lobe of the ear and there is now a facial paralysis on that side.

I have seen several cases of epithelioma of the external ear, the majority of them starting with epitheliomatous scales along the free margin of the concha. One case of particular interest came to my office in my absence and was seen by my associate, Dr. Lederman, who removed the entire external ear, and now after four years there is no recurrence. He put in a tube and thus kept the canal open. The man has good hearing now. Another case was relieved for a time, but there was recurrence. When I was a medical student, Dr. D. W. Yandell advocated a paste made of sulphuric acid and French soap-stone. He claimed results from it; but in one of the cases I here report there were two recurrences after its application.

DR. H. G. LANGWORTHY, Dubuque, Ia.: I think our sole interest in this paper lies in the question of recurrence. As the average man in a lifetime can scarcely expect to see many of these patients, therefore, he must have access to hospital records in order to follow up and get in touch with the cases again, or his report will not amount to much. Apparently most of these cases go to the general surgeon for treatment, rather than to the otologist.

It seems to me that the only treatment worthy of the name, even in apparently simple pinna cases, is radical, that is, removal of not only the auricle, but also about its insertion well down into the bone to make the possibility of recurrence as small as possible. When it is realized that in cancers of the external auditory meatus, what appear to be atypical, possibly cancer, cells wander out into bony spaces or are deposited by blood or lymph current, it is easy to understand that a recurrence involving the parotid region or temporal bone may be expected if the man lives long enough for it to occur.

Dr. H. Wood, Nashville, Tenn.: I have had two of these cases, the first, some six years ago, occurring in an old man who had extensive involvement of the glands all down the neck as far as the subclavicular glands. In that case I removed the auricle and the glands. It has not recurred in six years. Another case, seen three years ago, was an epithelioma of the auricle without glandular involvement. I amputated the auricle, but nothing more. I have only seen these two cases.

Dr. C. Fisher (closing discussion): I want to say that I did not try to discuss epithelioma of the middle ear. The cases I have seen, as well as those in the literature, were all fatal. They are almost invariably due to extension from the external ear.

TWO CASES OF EXTENSIVE FIBROMYXOMA OF THE NASOPHARYNX

JOHN EDWIN BROWN, M.D.
COLUMBUS, OHIO

Few of the various types of tumor of the nasal passages or nasopharynx are so rare as to make their cases of interest merely because of the pathological group to which they belong. But the location, extent, relation to surrounding tissues and secondary attachments may make any case of interest from the surgical questions it puts to the operator. These cases are reported because of the surgical difficulties they presented to me.

CASE 1.—Male, aged 17. The family history was negative on the father's side. The mother, aged 35, suffered from an exophthalmos of the left eye, associated with unilateral choked disk and a central absolute scotoma. A sister of the mother gave symptoms of inherited specific disease. The mother was under observation, taking large doses of potassium iodid, when the son was first brought to me. He was sent in by his family physician, Dr. C. A. C., and prepared for a tonsil-adenoid operation, which the local conditions plainly indicated. The operation revealed in addition an extreme deviation of the septum to the right, which was corrected by operation two weeks later. His right nasal stenosis was thought to be due to this until manipulations during operation revealed a mass projecting from lateral wall of posterior nares apparently directly back of the middle turbinal. It was dense in consistency and gave no free or pedunculated portion for easy surgical attack. The snare was tried unsuccessfully then and on two subsequent occasions, though small masses were secured for the pathologist. March 26, 1908, the inferior turbinal was removed to give better access to the growth. April 8, under local anesthesia, a loop of No. 5 wire was passed through the nasal passage, attached to a snare with an extra heavy cannula so that the loop encircled that portion of the tumor on the wall of the nasopharynx. The forefinger of one hand was used to keep the wire pressed as closely as possible to the wall of the pharynx as the loop was tightened. It was my original intention to snare off as much of the growth as the loop would engage and then similarly attack the remaining portion of the growth. As the wire was drawn home it was realized how firmly it was imbedded in the tissue. I therefore decided to make traction on the loop and use my finger in the nasopharynx to act as a blunt dissector to aid in separating the tumor from its attachments. The reward was a separation of the tumor in its entirety from its attachments, and

its withdrawal — somewhat difficult — through the anterior naris. The only laceration of the surrounding tissues was of a small strip of ethmoidal mucosa which came out with the tumor. The tumor itself was oblong, 55 mm. in length and 22 mm. in width. Its consistency was that of an ordinary fibroma. The hemorrhage after removal was slight, and there was no surgical shock. The patient has remained entirely well since its removal (five years ago).

Case 2.—G. J. H., aged 18. Family history good, father and mother and both paternal and maternal grandparents all living and healthy. He was referred to me by Drs. Crotti and McKenzie. He had the facial appearance of tonsil-adenoid disease, and had undergone, at the hands of a competent rhinologist, an operation for removal of tonsils and adenoids, and later a second operation under local anesthesia for a condition diagnosed as "polypus." Subsequent to the first operative procedure, a slight swelling that had appeared in the right cheek, had increased in size and, coincident with this, obstruction to the passage of air through the right nostril had become marked until at the time of his visit it was possible for the patient, by closing the opposite side, to aspirate only a trifle of air through the nostril, while none whatever could be forced outward. Only a short time before a surgeon of his home town had attempted an external operation on the swelling in the cheek. The operation was discontinued without removal of any tissue on account of hemorrhage and poor condition of the patient.

Examination disclosed a tumor mass which occupied the posterior third of the right nostril, was confluent with its outer wall and had become adherent to the septum where it was in contact with this posteriorly. A probe could be passed along the floor of the nostril into the nasopharynx. By posterior rhinoscopy this mass could be seen high in the vault and well to the side, affording no projecting or pendulous portion. The swelling in the cheek was evidently due to the growth outward through the sphenomaxillary fossa of a tumor, presumably the same as occupied the posterior nares. The boy's condition was rapidly growing worse. His physician stated that he seriously collapsed in the recent operative procedures. It was deemed unwise to attempt anything that did not promise the entire removal of the growth, and I advised approaching the tumor through the canine fossa and maxillary antrum. Under ether this operation was begun. The antral cavity was free from pus, but its posterior bony wall had disappeared and in this region was a dense mass continuous with the tumor in posterior nares and apparently with the mass in the cheek. It was difficult, by dull dissection, to free the mass from its attachments so that it could be grasped by strong forceps, and in the process a number of smaller masses were torn away from the tumor. The postnasal space had been plugged from below, but the hemorrhage was free and the patient's pulse showed profound collapse, so that ether was withdrawn and oxygen alone used during the

latter part of operation. The tumor was finally avulsed. It apparently had occupied the space of the posterior ethmoidal cells, sphenoid sinus, the sphenomaxillary fossa, and to a limited extent encroached on the space of the maxillary antrum. After packing, the patient was in serious collapse and pulse was not perceptible at the wrist. Dr. Crotti made transfusion of 70 c.c. of blood from the father to the patient by the indirect method he usually follows. Oxygen was used for twenty-four hours, together with large amount of strychnia and atropin. At the end of this time he showed signs of rallying and from that went on to recovery. At this time he is in the best health he has had for several years and examination shows no evidence of a return of growth. The region occupied by the tumor has healed, leaving, however, the sphenoid, posterior ethmoid and maxillary cavities confluent with the nasal passage.

The pathologist's report stated that this tumor was identical in nature with the first, namely, a fibroma of myxomatous character. Some uncertainty had attended the report on the sections from small specimens removed in the first case; but when one was obtained that was definitely from the tumor, there was no doubt as to its benign character.

[Since the above report, this case has come under observation for a possible return of growth, with severe hemorrhage from attempt to secure specimen for pathological examination. An additional note on the case will be presented later.]

Dr. J. J. Coons of Columbus made the pathologic report, confirmed in the first case by Dr. Bloodgood of Baltimore.

DISCUSSION

DR. S. H. LARGE, Cleveland: I want to congratulate Dr. Brown on getting his tumors out so nice and clean. One of the great troubles in these cases is the hemorrhage. And the question comes up as to whether it is better to give some preliminary therapeutic treatment before the operation. Either calcium chlorid, gelatin or human, horse- or rabbit-serum. Drs. Busch and Clowes have given us a powder derived from precipitating blood with a mixture of acetone and ether. This powder acts as well as human serum. Then there is the danger of shock. We have always given these patients a preliminary hypodermic of atropin and morphin to overcome it.

The patients I have operated on for fibroid have always been through the mouth, either using the method that Dr. Beck and Dr. Pynchon have advised, passing a rubber tube down to the epiglottis and packing around tube. In two cases I have had to make a division of the soft palate; and passing ligatures through either side, gives you very good view. A number of these cases are sessile and they grow from the basillar process of the occipital bone.

DR. JOSEPH C. BECK, Chicago: These two interesting cases—one particularly—interested me from the point of saving the patient's life. I think perhaps the transfusion that was used was the essential point. We know that method was created somewhere in Ohio, and particularly

in this country. Last year I had two cases of extreme postoperative hemorrhagic cases, one following an incision for peritonsillar abscess. The patient fainted and fell forward and probably struck quite a large vessel. Notwithstanding this patient was *in extremis*, he was transfused and lived. I would like the doctor to tell us how much objection he had in getting the donor in this proposition. It is important for us to be on the alert in using this means to save life as a last resort. We have encountered considerable difficulty in the coupling operation. One case I did myself and found considerable difficulty in getting the coupling fitted.

Intratracheal anesthesia is much better, as it is entirely out of the way and you get a measured quantity of anesthesia. Complete relaxation and drawing forward of the palate will give complete exposure of the part. Under such circumstances as the doctor had, with the cheek involved, I should have operated more extensively than he did; I would have made a temporary resection of the maxilla. This route we are following, as we are doing extensive work, and the scar is very little. You can reach the sphenomaxillary fossa, the antrum, nose or sinuses.

Dr. G. W. Boot, Chicago: In this connection I would like to report a case of fibroma of the nasopharynx which I had last summer in a young man of 26. The growth blocked both nares. Attempts had been made to remove it with a snare but without results. I finally succeeded in removing it by operating through the right naris, which was unusually wide. I passed a Struycken forceps through the right naris and succeeded in cutting off most of the attachment to the body of the sphenoid but I could not reach all of it in this way. I then passed a Tydings sickle-shaped tonsil knife through the naris and cut off the remainder of its attachment to the sphenoid. Then, with the same knife, I cut it free from the posterior border of the septum and from the velum and removed it through the mouth. Hemorrhage was very free during the operation but subsided quickly after it was finished. I wish to call attention to the usefulness of these two instruments in removing tumors so difficult of access as are these fibromas.

Dr. W. L. Ballenger, Chicago: In those cases which are mainly attached to the sphenoid I want to mention a method of using a modification of the Lowenberg adenoid forceps, only that it is much heavier. It has rounded cup-shaped tips. I have used it in a few cases of fibromas attached to the base of the sphenoid and some secondary attachments to the nose. Grasp the attachment of the tumor with this forceps, and then with a rocking motion you tear it loose as though it were an adenoid. Dr. Murphy assisted me in one in which we had to tie the external carotid. That was removed with this adenoid forceps. This is the only instrument I have had to use in a number of cases. The patient whom Dr. Murphy assisted me to operate is still living, a boy 14 years old, and quite healthy; I have heard from him quite recently. So in many cases you can remove them with adenoid instruments though not with the same ease and safety. Hemorrhage is often a factor of grave importance and renders the operation one of grave surgical magnitude.

Dr. J. E. Brown, Columbus, Ohio (closing discussion): In this first case the patient's general condition was good and there was a serious trouble following. I am convinced from my experience in cases of this kind that the traction method is the best. If you can get a good firm hold on the tumor, the cohesiveness of its elements is stronger than its adhesions to surrounding structures. This will keep it from tearing with small parts adhering to the surrounding tissues. In the second case, the patient was

not in good condition, having been referred to me by a general surgeon—Dr. Crotti of Columbus—who was present at the operation. We anticipated severe hemorrhage, were prepared to transfuse, and the father was only too glad to be the donor. The method followed was that of Dr. Crotti—the indirect, sterilizing the syringe in hot salt solution and then, while it is warm, taking the blood into the syringe from the vein of the donor and immediately injecting into the vein of the recipient. The doctor claims it is not the amount of blood given to the patient that accounts for the benefit, but there is something in the blood of a healthy donor which overcomes shock in these cases. I did not think I had such an enormous hemorrhage in this last case, but the patient went bad on the table, with enormous shock.

ON THE USE OF ELECTROMAGNETS IN THE EXTRACTION OF METALLIC BODIES FROM THE TRACHEA AND BRONCHI

WITH REPORT OF CASES

SAMUEL IGLAUER, B.S., M.D.
CINCINNATI

Electromagnets have been employed in a very limited number of cases in the extraction of foreign bodies from the deeper air-passages. With the perfection of the bronchoscope, the use of magnets has rightly fallen more and more into the background. It is the purpose of this paper to report two cases in which the magnet was tried, and to point out that there still remains a limited field in which magnets may be advantageously employed.

In the literature eleven cases are recorded in which extraction by electromagnets was undertaken. Seven of these cases were successful and four resulted in failure. To this list should be added the brilliant case which Dr. Lynch[1] has reported to-day, and one success and one failure of my own.

Garel,[2] in February, 1901, reported the case of an 18-months'-old child, in which a nail had been lodged in the right bronchus for two months. A radiogram showed the nail head up. A high tracheotomy was made and while the incision was held open with retractors an eye magnet was placed in the opening of the air-passage. The nail became dislodged and instantly attached itself to the magnet. The nail was 2¼ inches (6 cm.) long, and the magnet had attracted it through a distance of from 5 to 6 cm. The child recovered.

Piechaud's[3] case was recorded during the same year as that of Garel. A nail had become lodged in the left bronchus of a child 3½ years of age, and had been *in situ* for about six weeks.

A metal sound, curved on the end, was introduced through a tracheotomy, and was guided into the bronchus. The proximal end of the rod was then brought in contact with an electromagnet and the nail was thereby attracted to the distal end and successfully removed.

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1. Lynch: Tr. Amer. Acad. of Ophthal. and Otolaryngol., 1913.
2. Garel: Annal de Malad. D'l'oreille du larynx, etc.
3. Piechaud: Ref. Prota. Arch. Italiani d Larigol., 1903, xxiii, also Ref. Arch. Int. d Laryon No. 16, 1903, p. 598.

Two years later, Leromoyez and Guisez[4] reported the case of a man 26 years of age who had inspirated a small carpet tack eight weeks before. A radiogram at first revealed the tack (1 cm. long, with a head ½ cm. in diameter) in one of the divisions of the right bronchus. After an unsuccessful bronchoscopic examination, the tack passed further down and subsequently lower bronchoscopy showed the tack 1 to 2 cm. from the orifice of a bronchus of the third order. A specially constructed electromagnet was then introduced through the tracheotomy incision and the tack was removed at the first attempt. The whole procedure did not require five minutes. Recovery ensued.

In September, 1904, Hosmer[5] reported the removal of a shingle-nail from the left bronchus of a child. The nail, which had been *in situ* for 13 days, was extracted by an electromagnet provided with a long tip, which was introduced through a tracheal incision. Recovery.

Burk[6] records the case of a child who had inspirated an iron screw eleven days before. The screw was first located in the left main bronchus. Extraction with a bronchoscope failed at the first attempt. A radiogram, subsequent to this examination, showed that the foreign body had lodged in a lateral bronchus, but lower bronchoscopy failed to reveal its presence. Thereupon an elongated electromagnet was introduced through and 2 cm. beyond the bronchoscope, and the screw was removed without difficulty. Recovery.

The case of Dr. P. M. Hickey[7] was a very unusual one. A 3-year-old child inspirated a steel safety-pin. The Roentgen ray examination showed the pin in the trachea immediately below the larynx. Tracheotomy failed to expose the pin and the fluoroscope showed that it had passed downward until its lower end was in the right bronchus. "The child was placed under a giant magnet, the tip of the magnet being placed over the locality against the chest wall where the rays showed the pin was located. The giant magnet was then moved in the direction of the child's head and a slight cough showed that the pin was moving with the magnet. The tracheotomy tube was removed as the tip of the magnet approached the neck and the pin was pulled up through the tracheotomy wound." The pin had been in the bronchus for about thirty-six hours. Recovery.

4. Leromoyez and Guisez: Bull. et mem. de la hôpiteaux d Paris, December, 1903.
5. Hosmer: Ann. Surg., September, 1904.
6. Burk: Arch f. Laryngol. u Rhinol., vii, 151.
7. Hickey: Michigan State Med. Jour., January, 1910.

Martin[8] reported the case of an 8-year-old boy in whose right bronchus a screw, 1¼ inches long, had been lodged for five months. Subsequent to the inspiration of the foreign body, the patient had developed an abscess of the lung which had been drained through a resected rib, but the radiograph showed that the foreign body had not been removed during this operation. Under the guidance of the Roentgen ray a large forceps was passed through the external opening to the screw. A giant magnet was then brought into contact with the handle of the forceps and the screw was pulled out through the attraction of the magnet. Recovery.

In two unfortunate cases Massei[9] was unable to extract foreign bodies by the aid of an electromagnet. In the first, patient aged 3 years, a glass-headed pin was lodged in a bronchus, and in the second case a nail had become impacted (forty days) in the right bronchus of an 8-year-old boy.

An unsuccessful case was reported by Brokaw,[10] and one by Hubbard.[11] In the latter case an upholster tack had become lodged in the left bronchus of a 9-year-old child. Attempts at extraction with a magnet were unavailing, as the foreign body was impacted.

Brokaw's experience was almost identical with that of Hubbard, but he later succeeded in withdrawing the foreign body with a forceps.

REPORT OF AUTHOR'S CASES

The following case presents some very interesting and unusual features:

CASE 1.—The patient, S. R., male, aged 6 years, was first seen in consultation with Dr. F. Leever, Aug. 22, 1912. His parents stated that about three and a half years before he was supposed to have swallowed a metal screw. The stools had been watched, but the foreign body had not been found. No particular symptoms were noted at first, but after some time the child suffered frequently with a croupy cough, and was treated for bronchitis. In February, 1912, he went through a severe attack of pneumonia, lasting seven weeks. After the acute stage had passed, he came under the care of Dr. Leever, who found a consolidation of the lower lobe of the left lung. This failed to resolve during the next three months. During this period he had a very protracted cough with mucoid expectoration containing at times traces of blood, and accompanied by a septic irregular fever, ranging from normal

8. Martin: Practical Electro-Therapeutics and Roentgen-ray.
9. Massei: Ref. Prota. Op. Cit.
10. Brokaw: Ann. Surg., December, 1902.
11. Hubbard: Ref. Arch. Int. de Laryngol., No. 17, 1903, and personal communication.

to 103 to 104 F., and became "reduced to a skeleton" (weight 37½ pounds).

June 8, 1912, he suddenly expectorated a large amount of foul-smelling pus, slightly streaked with blood. After this, expectoration became very profuse, as much as 30 ounces a day, and the child always had a pus-basin with him.

Repeated examination for tubercle bacilli was negative. In the meantime he had developed clubbed fingers and toes, as well as an inguinal hernia. After a time the general condition improved somewhat so that the child was able to walk.

The diagnosis of an unresolved pneumonia with abscess formation was made by Dr. Leever and Dr. Lamb.

Accordingly, Aug. 22, 1912, a radiogram was made by Dr. Lange. This showed a consolidation of the left lower lobe of the lung, in which an abscess cavity containing a foreign body (a screw?) could be seen. It lay head downward at the termination of the left bronchus, opposite the fourth rib anteriorly and the seventh rib posteriorly (Fig. 1).

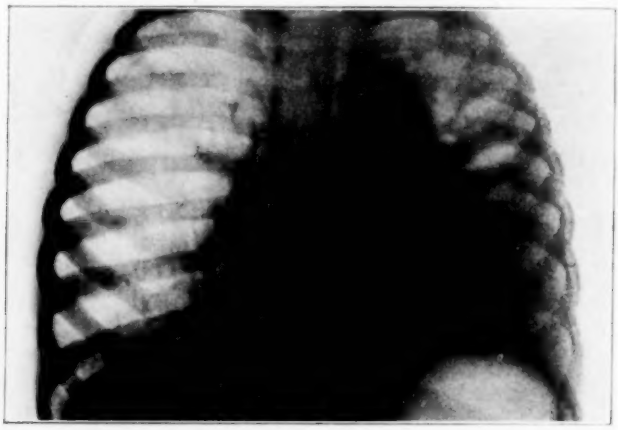

Fig. 1.—Radiogram showing an abscess of the left lung containing a metal screw. (Retouched.)

August 24, 1912, under general anesthesia (atropin hypodermically) upper bronchoscopy was undertaken. Owing to the dyspnea and profuse secretion, this was soon abandoned. A tracheotomy was then made, through which a bronchoscope was introduced into a large abscess cavity, at the termination of the left bronchus. A large amount of pus was pumped, mopped and coughed out through the tube, but the secretion was so profuse that after prolonged search the examination was discontinued and a tracheotomy tube was inserted.

Following this unsuccessful bronchoscopy, the giant-magnet designed by Dr. Ranly[12] was procured. This magnet, with a lifting power of 6,000 pounds, is provided at one pole with a flexible

12. Ranly, J.: Lancet-Clinic, March 17, 1906.

extension in the shape of a heavy chain through which the magnetic force may be applied where desired (Fig. 2).

In addition to this, a tracing was taken from the Roentgen ray plate, according to which a solid steel bar was patterned so that it would correspond to the line of the trachea and left bronchus. This rod was 9¼ inches long and ¼ inch in diameter and was flattened on the convex side so that it would not obstruct the right bronchus (Fig. 3).

Aug. 29, 1912, under local anesthesia (reinforced by atropin), lower bronchoscopy was again tried, but owing to the profuse secretion, again failed as before.

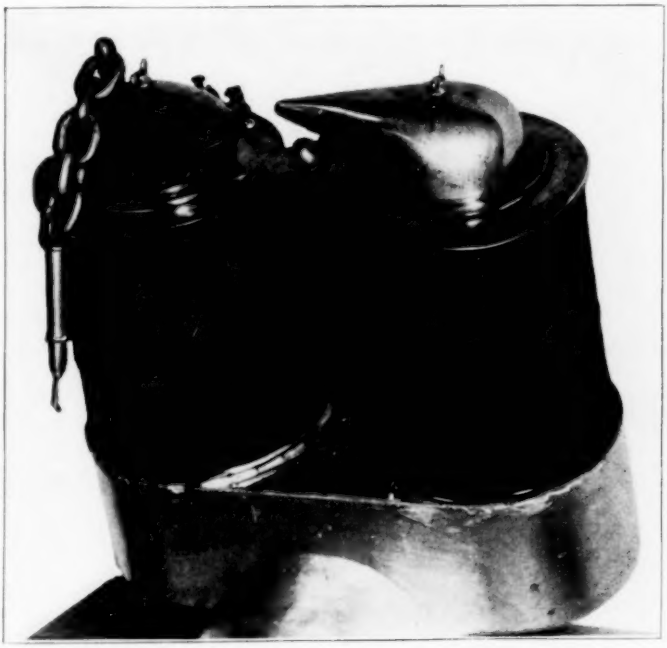

Fig. 2.—The giant-magnet of Dr. John Ranly.

A steel tube was next passed through the bronchoscope into the abscess cavity and was then connected with the magnet, but this failed to draw out the foreign body. The bronchoscope was then removed and the solid steel bar, guided by touch, was passed through the trachea and left bronchus into the abscess cavity.

The chain from the magnet was brought into contact with the bar and the current turned on. The operating-table and patient were then slowly pulled away from the magnet and the steel emerged from the trachea with the screw dangling on the end. The screw was badly corroded and measured three-fourths of an inch in length.

Subsequent History.—The tracheal cannula was first left out, but it became necessary to reintroduce it the same night. It was worn for twenty-four days thereafter, since expectoration continued profuse, and could be readily expelled through the cannula. Following the removal of the screw the patient gradually improved and gained in weight, while the expectoration diminished for several weeks, only to increase again after that.

Six months after the foreign body had been removed, the lung still remaining consolidated (slight fever, profuse expectoration, etc.), it was decided to drain the abscess externally. This was

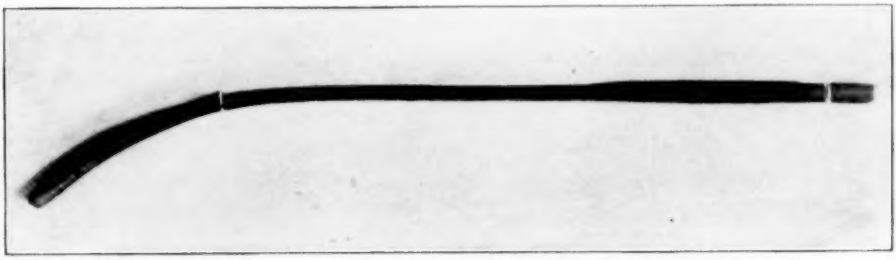

Fig. 3.—Steel rod which was magnetized and with which the screw was attracted and extracted.

done by Dr. Langdale. A second drainage operation became necessary three months later.

At the present time, the wound is still discharging somewhat; expectoration has almost ceased, and the patient has gained 15½ pounds in all.

The unusual features of this case were the length of time the foreign body had been *in situ* and its accidental discovery by the Roentgen ray after the diagnosis of abscess of the lung had been

Fig. 4.—The foreign body, actual size, removed by magnetic attraction.

made. The ease with which magnetic extraction was accomplished after bronchoscopy had failed is also worthy of note.

The following case is as interesting as Case 1:

Case 2.—Miss D. J., aged 19, was seen in consultation with Dr. Mithoefer, Oct. 1, 1912. She stated that a few hours before she had put some pins in her mouth and had choked on one of them. Some one in the factory where she worked had attempted to extract the pin with her fingers, but to no avail. Laryngoscopic examination at first failed to show the pin. A radiogram was

therefore taken by Dr. Lange, and this revealed the pin behind the epiglottis.

The laryngoscope then showed the foreign body in a vertical position immediately behind the epiglottis, with the head of the pin resting at the anterior commissure and the tip imbedded loosely in the epiglottis. It seemed as if the pin might at any moment topple off into the trachea.

On request, the patient produced a pin which she declared was identical with the one she had swallowed. This companion pin proved to be easily magnetized, and it was explained to the patient that we desired to extract the pin with a magnet, as I feared that the forceps might easily dislodge the foreign body.

The patient was taken to the office of Dr. Ranly. The larynx was cocainized (by the drop method) and a curved steel bar was being magnetized by contact with the magnet. The first attempt failed and on a second attempt the pin, much to our chagrin, became dislodged and disappeared.

A radiogram immediately afterward showed the pin in a lower division of the left bronchus. The following day, assisted by Drs. Murphy and Mithoefer, I made a prolonged search for the pin by upper bronchoscopy, but it could not be found.

Oct. 4, 1912, Dr. Murphy and I took the patient to Pittsburgh to consult Dr. Chevalier Jackson, who considered it a very difficult case. He made a prolonged bronchoscopic search for the foreign body, but was unable to find it. A few days later he made a second unsuccessful search for the pin. Oct. 12, 1912, the patient developed pneumothorax. Dr. Hartley Anderson then removed the pin from the lung through an external operation. The pin, after its removal, was tested with a magnet, but could not be magnetized. The patient recovered, and in a few weeks the lung had fully expanded.

In this case extraction with a magnet seemed a perfectly rational procedure, but I was led astray by the companion pin which the patient presented. The failure in this case was as disappointing as was the satisfaction in the first case.

EXPERIMENTS ON ANIMALS

In all the clinical cases heretofore recorded the magnet has been applied through a tracheotomy. De Roaldes,[13] in a series of experiments on the cadaver, was unable to guide an object from the trachea through the larynx into the mouth. He suggested the use of two magnets, one to be applied over the trachea and the other to be introduced into the mouth.

In some recent experiments, assisted by Dr. Ranly, I have undertaken the direct extraction of magnetizable bodies from the tracheas and bronchi of dogs, by the attraction of magnetized

13. De Roaldes: Rev. Heb. de Laryngol. and d'Otology, Jan. 4, 1902.

steel rods, *introduced through the larynx,* into the deeper air-passages.

Four dogs were used: one of these was a dead animal and three were living anesthetized animals. One of the latter died after three experiments had been performed.

The procedure was as follows:

A foreign body (nail, bolt, screw or needle) was introduced through a bronchoscope into the lower trachea or into a bronchus. The bronchoscope was then removed and a steel rod was passed through the larynx into the deeper air-passages. In order to attract the foreign body, the rod was then magnetized by contact with the electromagnet.

At different times fifteen objects were in this manner introduced through the larynx, while one was inserted through a tracheotomy.

Of the fifteen foreign bodies, six were recovered by *per vias naturales* and two through a tracheotomy.

Since the rods were of smaller diameter than the trachea the animals were not asphyxiated when the rods were introduced.

The one foreign body introduced through the trachea could not be recovered. Of the total number of objects recovered, all but one were from live animals, and of the eight objects recovered, four had been in the bronchi and four in the trachea.

Prota[14] records some similar experiments, all of which, however, were performed through the open trachea of the animals.

From the results of his experiments, as well as from my own, the conclusion may be drawn that the metallic bodies must be free, or very loosely impacted in the trachea-bronchial tract if they are to be extracted by a magnet.

Jackson's[15] article contains a similar conclusion.

In exceptional instances, in human beings, it might be possible to combine suspension laryngoscopy and magnetic attraction by means of steel rods passed through the suspension laryngoscope, corresponding to the experiments on animals recorded above.

A review of the recorded clinical cases, as well as of my own, leads to the conclusion that in exceptional instances the electromagnet may prove of great value in the extraction of foreign bodies from the lungs. These cases would be limited to that group in which the foreign body was beyond the reach of a bronchoscope or was concealed in profuse secretions. The magnet

14. Prota: Op. Cit.
15. Jackson, Chevalier: Laryngoscope, April, 1905.

may also attract the foreign bodies and thereby shorten the search when an external operation becomes necessary. In the vast majority of instances, however, the bronchoscope will remain the instrument of choice.

DISCUSSION

Dr. John Ranly, Cincinnati: The magnet used by Dr. Iglauer in his cases as you notice from the picture differs from most eye magnets, in so far as it is a bipolar magnet. You all know the increased strength of the little horseshoe magnet over the bar magnet. By building a magnet, designed along the lines of a horseshoe, we get much more power with a lesser amount of material, and it may surprise you that the magnet weighing about 800 pounds thus built has a lifting power of 6,000 pounds. As you notice in the picture, the two blunt-pointed pole pieces are so arranged they can be brought together within 1 inch of each other; they may be turned so that the pole ends take on any relative position.

We may remove one of the pole pieces and replace same with a pointed tip after Haab.

A flexible extension arm can be placed on one of the poles as shown in the picture, or as we did in the first magnet built, by having the Haab tip so constructed (in two sections) that by removal of the anterior portion a chambered core face is obtained. To this we fasten the flexible extension arm.

This arm consists of several links with a hand piece, on which various end tips may be attached and which, while full power is on, may be moved as easily as a cataract knife. The ball you notice on one of the pole pieces serves as an indicator that the current is flowing by striking with a loud click against the pole piece. It is considered more practical than the original glow lamp.

The magnet being built in several sections, (practically consisting of several magnets) is a factor in modifying the amount of magnetism exerted and also prevents the instrument from getting hot. The apparatus may be used for hours uninterruptedly and will become 42 degrees warmer than the room temperature. As all other magnets, it has a rheostat for its control.

It was Dr. Iglauer who first called my attention to the possibility of the magnet in the field of the respiratory tract, and it was a source of great pleasure to me to cooperate with him in his endeavors to extend the use of the magnet in this surgical field.

Since new facts must be considered when the magnet is used in this field, I thought it might be well to speak about the effect to be obtained from the same magnet under difficult conditions thereby proving the value and necessity of getting as much as possible within the field of magnetic flux so as to get best results.

Explaining this more carefully, may say that the magnetic lines of force within the magnetic circuit must be considered in every case; because, the closer the pole ends are together and the closer the foreign body is to the center of the magnetic field, the more easily it is moved. Following along these lines we conducted some experiments.

We picked these bodies because they contain some steel and are in common use. Nos. 1, 2, 3 and 4 are not too large to be considered nor so small as to not show an appreciable difference.

No. 5 is a piece of steel recently removed, having been embedded for four weeks in the left orbit, below the eyeball. It entered about 2 mm. above the orbital ridge of the superior maxillary bone.

Where we say "suspension," it means that the article is suspended on a thread, which is suspended from another thread, arranged horizontally, running parallel with the magnet, 3 feet above same. "With friction," means that the article was placed on a journal.

Article No. 5 on account of its small size could not very well be suspended, so it was placed on the journal only.

No 1 is a small flat top screw.

No. 2 is a small round top screw.

No. 3 is a long round top screw.

No. 4 is a nail.

No. 5 is a piece of steel, described above.

EXPERIMENT No. 1.—USING BOTH BLUNT TIPS, BOTH HORIZONTAL

	No. 1	No. 2	No. 3	No. 4	No. 5
Suspension	880 mm.	295 mm.	345 mm.	435 mm.	
With friction	180 mm.	180 mm.	200 mm.	280 mm.	180 mm.

EXPERIMENT No. 2.—ONE BLUNT TIP REPLACED BY HAAB TIP AND LATTER USED FOR EXPERIMENT

	No. 1	No. 2	No. 3	No. 4	No. 5
Suspension	230 mm.	240 mm.	280 mm.	380 mm.	
With friction	125 mm.	125 mm.	189 mm.	230 mm.	145 mm.

EXPERIMENT No. 3.—FLEXIBLE EXTENSION TIP

	No. 1	No. 2	No. 3	No. 4	No. 5
Suspension	60 mm.	75 mm.	90 mm.	110 mm.	
With friction	20 mm.	25 mm.	20 mm.	60 mm.	10 mm.

EXPERIMENT No. 4.—SAME AND EXTENSION OF OTHER POLE BY ROD IRON POLE 2½ INCHES DIAMETER, 14 INCHES LONG. DISTANCE OF TWO POLES, 15 CM.

	No. 1	No. 2	No. 3	No. 4	No. 5
Suspension	75 mm.	90 mm.	105 mm.	125 mm.	
With friction	30 mm.	35 mm.	30 mm.	70 mm.	25 mm.

In comparing these articles and considering Nos. 1 and 2 we find little difference; but can notice that when the magnet is weaker No. 2 is more easily attracted, due to the amount and character of magnetizable material, a condition usually unknown to the operator and which warns us to always make use of all details leading to the success of the operation.

In comparing No. 3 with these two we find considerable difference or diminished effect of the magnet, undoubtedly caused by its larger area of friction.

In considering No. 4, the nail, we see less interference with friction, since it has only two parts at which friction is present.

No. 5, as stated before, was only used with friction and was attracted almost as easily as Nos. 1 and 2, proving that it was a material much more easily magnetized.

Having compared these individually, I beg of you to notice the decrease in power when the Haab tip was used instead of the curved tip, meaning a further distance of the two pole ends and therefore a reduction, as it were, of the strength of the magnet.

In looking at Experiment 3 when the flexible extension was used, and comparing it with No. 4 when the second pole was extended by use of a rod (iron pole), we find considerable increase of power by thus extending the second or opposite pole end.

This latter experiment I consider of great importance in such cases as have been reported by Dr. Lynch and Dr. Iglauer. If in such cases we use a bipolar magnet and introduce the one end, as both men did in their respective cases, and then extend the second pole on the outside of the patient, we will more easily get our article, as the strength of the magnet is thus very much increased.

In conclusion; we may say as did Dr. Iglauer, that the bronchoscope is the instrument to be first used in routine work. Should its use be unavailing, the next question in our minds is, Does the particle contain some substance which can be attacked by the magnet or not? We want to remember that not only iron, steel or nickel can be magnetized, but also some newly discovered alloys of copper, magnesium and aluminum (Henssler alloys).

We must have a magnet powerful enough and must make conditions most favorable for easy attraction, as Dr. Iglauer has well demonstrated in his case. For you may well see, after considering the above table and seeing how the magnetic power is reduced by friction and by distance, that the anatomical knowledge and exact location of the foreign body as shown by the Roentgen ray were of great importance in ordering the properly curved rod which led to the successful extraction.

REMOVAL OF A WIRE NAIL FROM THE STEM BRONCHUS TO THE LOWER LOBE OF THE RIGHT LUNG

R. Clyde Lynch, M.D.
NEW ORLEANS

Odessa May, 4 years old, while playing on the floor of her home, allowed a fivepenny wire nail to slip into the trachea. Violent fits of coughing and dyspnea attracted the parents' attention to the accident, and relief was sought at once. She was taken to Beaumont, and from there to Houston and Galveston, where a tracheotomy was performed and many attempts made for its removal. She was then brought to Dr. E. D. Fenner of New Orleans, with whom I saw the patient in consultation.

Dr. Fenner immediately procured a satisfactory Roentgen ray plate, which showed the nail lying deep in the right lung, between the seventh and tenth ribs, and with the aid of the Jackson positive overly film of the bronchial tree the nail was found to be located in the stem bronchus, to the lower lobe of the right lung, with its head up, apparently imbedded in the side of the bronchus, and about one-half inch of its point-end in one of the bronchiole offshoots.

A close study of the print will give an exact idea of its location, as was proved during the manipulations in the removal. These films will surely aid to a considerable degree in the proper localization of foreign bodies, especially where they are of small size and find their way into the smaller branches of the stem bronchus. While the Roentgen ray plate showed the nail to be located in the right lung, between the seventh and tenth ribs, it was a source of great satisfaction to have a more accurate picture of the nail in the bronchus made possible by the Jackson films; and had I paid more attention to the detail of its location, I would have removed the foreign body with more promptness.

The film overly shows the head of the nail lying obliquely in the stem bronchus, with the head pressing or being imbedded in one of its walls instead of lying directly in the lumen. This was found to be accurate, for the scope was directed down past the nail for a distance of half an inch or more, as was shown by the fluoroscope during the process of extraction.

The nail had been in this position for seven weeks, and though the child suffered but little there was some loss of weight, due to previous manipulations. Except for some dulness over the lower lobe of the right lung, a few moist râles and an occasional flash of temperature, she gave no serious evidence of pulmonary involvement.

An attempt to remove the nail was made, but the smallest tube at my disposal was too large to enter the bronchus; this was a 7 mm. of the original Killian set. Chagrined at this failure, I decided to prepare for the next attempt, and take advantage of every aid possible at my disposal. I procured the Killian baby set of bronchoscopes with the five forceps accompanying. These tubes, six in number, range in sizes small enough to enter the smallest bronchus.

In order that I might follow the movements of the bronchoscope in its journey to the foreign body with the Roentgen ray, I constructed a canvas cot, to be placed on two wooden trucks, so that the Roentgen ray tube could be put beneath the cot and the fluoroscope used over the area under examination. I had the instrument maker prepare for me a small steel rod, long enough to pass through the scope, and to be attached to our giant magnet, hoping that if I were unable to catch the nail with the forceps I might deliver it with the magnet.

The cot would then act as a stretcher, and permit of the removal of the child with the bronchoscope *in situ,* without disturbing the position of the instrument, since the magnet is in one room and the Roentgen ray in another.

Under the general anesthesia (ether-vapor), with Drs. Fenner and Logan assisting, and Dr. Henriques, special radiologist in charge of the fluoroscope, I proceeded to enter the trachea through the low tracheotomy wound made previously in Texas, using the Number 6 baby Killian tube 4 mm. in diameter, illuminated by a Brunnings handle. Passing the bifurcation, I entered the right main bronchus to the upper lobe and proceeded on down to the lower lobe. The fluoroscope used at this instance showed the instrument about 1 inch from the foreign body. Bleeding here was somewhat annoying and interfered with vision. Adrenalin on small cotton applicators controlled this very nicely and facilitated the passage of the bronchoscope down to the offending body. The fluoroscope showed the scope to be at the foreign body, though it could neither be seen through the tube nor felt with a probe. The child was very carefully turned to the left lateral position, and

in this position the scope was again seen to be in a plane with the nail. In this position the Killian tube, passed through the mouth, would not have been long enough to reach the foreign body, for the tip of the instrument was below the angle of the lower jaw, projecting not more than 1 inch beyond the low tracheotomy wound.

After biting away some granulation tissue the nail could be felt with a probe, but many attempts with the forceps failed to grasp it. Under the direction of the radiologist the forceps were opened, passing down beyond the head and closed, but they would not take hold, or they would slip off.

Since I was able to pass the bronchoscope beyond the nail, I felt sure the location, as shown by the Jackson film, was correct, so withdrawing the tube to the proper point and deflecting its distal end slightly to the right, I was able to feel the nail perfectly.

We then carried the child to the magnet, the steel rod was passed down through the tube, and I felt and heard it come in contact with the nail. With the rod in contact with the magnet, the current was turned on and the rod was withdrawn; after two attempts at this the forceps were tried again, this time using the small hook forceps intended for the removal of beans, etc. When these were used it felt as though the nail had been loosened from its bed and was lying free in the lumen of the bronchus. It was grasped easily, and since the head was too large to come through the bronchoscope, the instrument, forceps and foreign body were removed at the same time.

Immediately following the delivery there was considerable bleeding, and our patient was practically awake from the anesthetic, so the cough reflex was active, and she was able to free the trachea of this accumulation.

A tracheotomy tube was inserted and the patient stimulated and put to bed in a room previously warmed with benzoin steam. Room temperature was maintained at about 88 F. for forty-eight hours, then gradually cooled to air temperature. Chest was rubbed with oil of turpentine (1/6) every half hour until surface was red. The tube was guarded carefully and the dressing changed frequently. In seventy-two hours all secretions had stopped, lung sounds were clear, temperature was normal, and the tube was removed. Forty-eight hours later the tracheal wound was about closed, and in six days she left the hospital as cured.

I was impressed with the usefulness of the Jackson film in accurately locating this foreign body, with the great help afforded

by the conjoined use of the Roentgen ray and bronchoscope; and lastly, while I am a wee bit doubtful as to the part played by the magnet, I am sure that some change in the position of the nail occurred after its use, for I was able to feel the nail free in the lumen of the bronchus, and to grasp it easily with the forceps then, when I had failed repeatedly before the use of the magnet.

This magnet is an improved Haab and its zone of attraction for bodies of this kind is about 9¾ inches, as worked out by Dr. A. W. de Roaldes, who experimented considerably with this method and reported his results in 1899. Attaching the steel rod, 13 inches long and one-eighth inch in diameter, to the magnet, the wire nail was started at 3 inches, so there may have been sufficient force exerted on the nail to at least loosen it from its bed and thereby facilitate its removal by the forceps.

THE TECHNIC INVOLVED IN THE REMOVAL OF FOREIGN BODIES FROM THE ESOPHAGUS

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MEMPHIS, TENN.

The literature of esophagoscopy has been enriched during the past two or three years with articles devoted to the subject of the removal of foreign bodies from the esophagus by means of the direct method, and there remains nothing particularly new to add to the contributions already made to the subject. However, every one who does more or less of this work is in a position to draw some conclusions pertaining to the technic involved, and also to make observations concerning results drawn from his own experience.

The anatomical structure of the esophagus is such that of necessity a large majority of the foreign bodies becoming lodged therein are found in the upper third, usually in the immediate neighborhood of the suprasternal notch. Once past the cervical end, foreign bodies are more than likely to go on to the stomach. It would seem that with the direct method, using either the instruments of Jackson or Brünings, the removal of objects from this portion of the esophagus, almost within reach of the index-finger, would be a procedure so simple in character as to demand no special technical skill; but for my part, I must confess I have found that this demands as much, or even more, skill than does an uncomplicated bronchoscopy. Furthermore, I believe that it is a much more dangerous procedure than is bronchoscopy. My personal experience numbers one fatality in esophagoscopy, this being due perhaps largely to the neglect of those attending the child after operation, but it nevertheless shows very clearly the possibility of fatal outcome in this work. The case was previously reported by me, and briefly was that of a child 2 years of age who had a large overall button, 23 mm. in diameter, lodged in the esophagus just above the suprasternal notch. This was extracted with some difficulty, it being firmly impacted, and the nurse in the ward of the hospital was cautioned to watch the child closely, and at the first indication of difficult breathing was to summon me or someone else to do a tracheotomy. The child began breathing with difficulty about 2:30 o'clock in the morning and was allowed gradually to choke to death, dying about 6:30 a. m., when a simple

tracheotomy, admitting of respiration until the laryngeal edema had subsided, would have saved the child's life.

Even though the walls of the esophagus are yielding in character, the danger of producing traumatism which may result in a fatal esophagitis, or of producing perforation, with inevitable fatality, is always present.

Faulty technic in the introduction of the tube, should such be used, is usually responsible for this. Instrumentation in the effort to seize and dislodge the foreign body likewise may cause the fatal lesion, and there is always the danger present of wounding the tissues immediately back of the larynx in the process of extracting the foreign body, which may cause an edema of the glottis, as in the case related by me, with death from asphyxiation, unless a tracheotomy promptly is done.

The first case of foreign body in the esophagus removed endoscopically by me was that of a 2-year-old child with a 5-cent piece in its esophagus, and here I used a Jackson esophagoscope. I well recall the mortification I experienced in this case of seizing the coin with a Jackson alligator forceps, and then seeing it several times successively slip back. Finally, thinking that I could estimate the distance of the coin from the end of the tube by measurements of the tube in comparison with the forceps, I found that I had been endeavoring to extract the coin with a bronchoscope forceps, which barely reached beyond the end of the esophagus. Changing quickly to a longer forceps, the coin was extracted without any difficulty whatsoever. This was an experience in faulty technic which will not occur again, but which, if I had not discovered my error at the time, might have resulted in failure to obtain the foreign body, for, had I not succeeded at this time, I am sure the parents of the child would have taken her home to the country and probably never would have returned for a further attempt at extraction. Another time I endeavored to remove a 25-cent piece from the esophagus of a negro child about 3 years of age, and time after time introduced the Jackson esophagoscope and Brüning's 7 mm. tracheoscope, but each time failed to find the coin, although the end of the tube did pass beyond the point indicated by an excellent radiogram as the location of the coin. This was due to the coin being lodged in a diverticulum, and this also should be borne in mind as a possible cause of failure to remove a foreign body from the esophagus.

Overriding of flat foreign bodies, such as coins, also is to be anticipated, the tube passing the object without disclosing it. Lat-

terly I have discontinued using the esophagoscope and the tracheoscope in these cases of foreign bodies in the upper third of the esophagus, for I find that the Jackson speculum, with slide removed, is the most satisfactory instrument to use in these cases. With the child in the dorsal position, using the straight-head position of Johnson, the end of this speculum is placed beneath the epiglottis, the larynx lifted well forward, and thus the upper portion of the esophagus is exposed. Most foreign bodies in this region can thus be seen and removed.

Finding the standard 36 and 60 cm. alligator forceps of Jackson rather awkward to manipulate on account of their length when this speculum is used, I had the makers of Jackson's instruments make me an alligator forceps of his pattern only 25 cm. long, which is amply long for reaching as far as is necessary into the esophagus, yet at the same time does not embarrass one's manipulations because of its length.

It is argued by some that it is never necessary to use a general anesthetic in young children for removing foreign bodies from the esophagus, but I must admit that in several cases which I have handled I have found a general anesthetic renders the difficulties of technic less and materially reduces the liability to unfortunate traumatism through the unexpected movements of the child, which may come even when the patient is apparently most securely held. It is quite true that the danger from the anesthetic is not to be minimized in these cases. Cocain I never use in young children, owing to their susceptibility to the effects of this drug; and, although anesthesia is thus obtained, the terror of the child at the surroundings and manipulations being undertaken is in nowise diminished, and the value of the local anesthesia is negatived. If a general anesthetic is not used in these cases I think it much better to merely hold the child and not attempt local anesthesia of any kind. A very important advantage in connection with general anethesia should not be overlooked, and that is, the contraction of the esophagus on the foreign body, sometimes resulting in its firm fixation, is avoided, and the object is therefore much easier of removal.

Twisting of the head, or its flexion to one side or the other, causing deviation of the esophagus from the direct line, is a frequent source of difficulty in introducing the esophagoscope or instruments for extraction of the foreign body, due to the fact that the end of the instrument is met by the opposing esophageal wall. Undue force used under such conditions may produce lacer-

ation of the wall of the esophagus, or even perforation, with a fatal esophagitis as the consequence. Even when the Jackson speculum is used care must be taken to have the head held straight with the neck, otherwise the foreign body will not be seen, and instruments cannot satisfactorily be introduced within the esophagus. I find Johnston's straight-head position the easiest to use, and also the most satisfactory, when using the Jackson speculum, as it does not require the careful holding of the head that the Boyce position demands. In using the esophagoscope, I have found the Boyce position preferable, for the length of the instrument prevents its introduction without the head being flexed backward or dropped over the table, the neck then being extended.

For foreign bodies which are located below the level of the suprasternal notch, a seldom occurrence in my experience, I am in the habit of using a Brüning's tracheoscope. This is passed with the head in the extended position, hanging over the table, and with the brilliant illumination afforded by the electroscope the end of the instrument can carefully be guided and the approach to the foreign body immediately noted. Pressure upward against the trachea must be avoided in introducing the instrument, since this technical error will instantly impede respiration, and respiratory interference must carefully be avoided in this work.

Vigorous and sustained efforts to locate a foreign body in the esophagus should not be made. It is far better to withdraw the instrument, rest the patient, and endeavor to study out the technical difficulty which has occasioned failure. If the technic is correct the esophagus is not difficult to enter.

Traumatisms to the mucosa occur at times even with the most careful handling, as the mucous membrane of the esophagus is so vascular that it bleeds at the merest touch. For clearing away secretions, I use adrenalin tape in sponge holders, this being convenient to cut into small pieces, does not ravel readily, and is less likely to leave particles behind than is absorbent cotton. In upper esophagoscopy very little sponging is necessary, but when the foreign body is located lower down the esophagus, considerable quantities of mucus may accumulate above it and require constant sponging, or use of either the Jackson or Brüning aspirator to clear the esophagus sufficiently for the foreign body to be seen. I do not expect any particular astringent action from this tape on account of its being impregnated with adrenalin, since it does not remain long enough in contact with mucosa to

impart this, but it is a soft and finely woven gauze and put up in a convenient package for handling.

It is remarkable what large foreign bodies may become impacted in the infantile esophagus. The average diameter of the esophagus of a 2-year-old child is about 10 mm., but I have removed an object 23 mm. wide from the upper portion of the esophagus of a child of this age. After the foreign body has remained in the esophagus for a few days its irritating action has set up a local esophagitis, with a contraction of the esophageal walls around the object, to such an extent as at times rendering removal rather difficult, especially when the operator realizes the necessity of extreme care, to avoid traumatism. Bathing the surrounding walls of the esophagus with adrenalin, of standard solution, materially aids the extraction of objects thus impacted. I desire, furthermore, to mention the valuable aid to be derived from a preliminary hypodermic injection of morphin and atropin in cases of esophageal foreign body, given a half-hour or more before instrumentation is begun, in order to secure the quieting effect of the morphin, and the decided advantage of lessened secretion from the action of the atropin.

As already remarked, esophagoscopy has never appealed to me as being particularly easy of accomplishment. Every step of the procedure should be characterized by the greatest gentleness and care in manipulation. We are dealing with an exceedingly delicate structure, whose function is the conveyance of well-anointed food boluses to the stomach, and I know of no structure in the body where the reaction to traumatism is likely to be more rapid and more active. A fatal outcome may even be the result of the most conscientious but misguided efforts.

Memphis Trust Building.

DISCUSSION ON PAPERS OF DRS. LYNCH AND McKINNEY

DR. G. W. MACKENZIE, Philadelphia: I just want to cite briefly a sad case I had recently and ask Dr. McKinney for suggestions as to how to handle a similar case in the future. About three weeks ago I had a child 7 months old, with a safety pin in the esophagus, point up, and about in the region of the isthmus. I tried the esophagoscope of the Kahler type, the 6 mm. tube, and had no difficulty in introducing it, but I could not see very well. Before attempting to remove it, I tried a Lerche safety pin extractor with a worm probe and wire snare. I tried it with the pin on the table and found it was rather impracticable. So I abandoned the instrument and used a double tenaculum forceps which worked well. On introducing the tube and operating the instruments, I was not sure whether I had the pin or mucous membrane, and I had a hard time of it without results. The patient had very little shock. I might say, too, that I tried an 8 mm. tube after failing with the 6.

The pictures made showed that the pin was in the stomach. Twenty-four hours afterward the child suddenly collapsed and died. We had a post-mortem, which showed a small tear of the esophagus near the cardiac end of the stomach and the left pleural cavity was filled with a substance like cream of tomato soup. Pathological examination showed no food products in it. The pin had been there from the night before, eighteen or twenty hours. Now is it possible that the magnet might have been brought to play, or would you have considered it good technic to push it into the stomach invert the pin and bring it out?

Dr. Richmond McKinney, Memphis, Tenn., (closing discussion): In a case of the kind described by Dr. MacKenzie, I think a safety-pin closer, such as that of Mosher, is the best to use; and, in the absence of one's ability to close the pin, it either would have to be cut in two, or else pushed back into the stomach and turned. If the pin can be reversed, it usually comes out easily. I do not believe the magnet would have done any good in Dr. MacKenzie's case, since the point of the pin caught the esophageal wall, and therefore it could not have been drawn up that way. Certainly this case was a very difficult one to handle, and any kind of technic is faulty under such circumstances in a child of that age.

Casselberry has devised a very ingenious instrument for cutting a pin in two, but of course everybody does not have it handy to use. I really do not believe that I could offer any suggestions which would have made the task in Dr. MacKenzie's case any easier. As to what produced death in his case, I cannot positively say, but if the esophagus was punctured by the pin, of course the cause of death is apparent.

Dr. R. C. Lynch, New Orleans, La., (closing discussion): I would suggest to Dr. McKinney the use of Mosher's oval esophagoscope for the removal of foreign bodies where the round tube slips down over the foreign body; one might grasp it by ballooning the esophagus. I think Dr. Iglauer is to be complimented on his cases. I want to say to Dr. Ranly that I started to put the tip of the magnet over the region of the foreign body and follow it up that way, but was afraid of bruising the mucous membrane and setting up an emphysema. In picking off the granulations to get to the place I made up my mind I was going to have some emphysema. Dr. Jackson recommends that you push those safety pins down into the stomach when by turning you can get them out easier. It seems to me I would have pushed it down into the stomach. I wonder whether dilating the esophagus by ballooning would have helped. The method works beautifully. I had one case of esophageal stricture in which I ballooned the esophagus on going in, and after the stomach was filled up with air the air bubbles came back through the stricture and I was able to continue dilatation after this procedure. I saw a case of rupture of the esophagus by the blind use of a bougie. Death was very rapid, eight hours following the accident.

Dr. Samuel Iglauer, Cincinnati, (closing discussion): I am glad that Dr. McKinney has pointed out that esophagoscopy is a difficult art. I think the point ought to be emphasized in this Society that esophagoscopy is sometimes a dangerous procedure and one may look for a fatal result when one least expects it. Some years ago, I reported a case before this Society where I undoubtedly ruptured a carcinomatous stricture and hastened the patient's end. Some time ago, I had a case of an open safety pin, point up, in the esophagus, in a baby 10 months of age. I tried pin-closing devices, but failed, and finally used a strong forceps to draw the pointed pin-end into my tube, leaving the clasp-end on the

outside of the tube, and then pulled out pin, instrument and all. This may not have been good technic, but the child made a good recovery.

Dr. McKinney brought out a good point, and that is, if at first you do not succeed, try again, but do not try too often nor too long on the same day. Prolonged search may cause some bleeding and is very fatiguing for the operator. If you go back in two or three days, you will succeed better than if you prolong the first operation.

I had one case where a child probably had edema of the larynx after a tracheoscopic examination. This child had been in the hospital with diphtheria, but recovered and probably had some myocardial affection after its illness. Subsequently after it had been out for several weeks, it was referred to me for examination as to the cause of a persistent cough. I made a tracheoscopic examination under general anesthesia and put the child to bed. Half an hour after reaching my office they telephoned me the child was doing badly, and I advised a tracheotomy. Before I could reach the hospital the child had died, but no tracheotomy had been done. The patient probably died of edema of its larynx, although the heart may have failed from the effects of the anesthetic.

In working in the esophagus I think insufflation anesthesia is a great aid, because the patient can be kept thoroughly anesthetized without interfering with the operator.

A NEW ESOPHAGOSCOPE *

RICHARD LEWISOHN, M.D.
NEW YORK CITY

I presume that you may consider it somewhat unusual for a general surgeon to present before your meeting a new instrument for throat work. I have been interested for a number of years in the clinical and surgical aspects of diseases of the esophagus, and especially cancer. You know that diseases of the esophagus since the introduction of the Sauerbruch chamber are amenable to surgical interference. To be sure, up to a few months ago all cases of resection of the esophagus for cancer have ended fatally. However, all the work done in Europe and in this country along these lines has not been in vain, and has, after many years of disappointing efforts, resulted in the first successful resection of an intrathoracic esophageal cancer by Dr. Torek in New York.

To further the work in this special field and to be able to make the diagnosis of esophageal cancer in its very early stages, we need an instrument for examination which can be easily introduced without general anesthesia and without great discomfort to the patient.

The new instrument which I am going to present to you now was not constructed for those who have mastered the use of the straight tube. But I think even in this audience of specialists quite a number of you will agree with me on the difficulties of the straight tube method, and therefore may be interested in seeing an instrument which simplifies esophagoscopy materially.

The new instrument was so constructed that it adapts itself to two main requirements: one, the introduction is possible in the normal position of the head; and two, the instrument is passed down in the longitudinal axis of the esophagus and not at an angle to this axis. In regard to the first requirement, the position of the patient during the introduction of the straight tube is a very uncomfortable one. We do not take into consideration the right angle normally existing between mouth and esophagus, but we try by hyperextending the head to convert this right angle as far as possible into a straight line. This procedure means a great discomfort to the patient. Why shall we, however, adapt the patient

* Read by Invitation.

to the instrument? I think it is much more logical to adapt your instrument to the patient, and in constructing my instrument I laid great stress on the point that during the whole examination the patient must sit in normal position.

As to the second requirement, even if we hyperextend the head as far as possible, we do not convert the axis of the mouth and the axis of the esophagus into a straight line. Consequently, the straight instrument does not pass down in the longitudinal axis of the esophagus, but at a more or less obtuse angle. This is the reason why in a good many cases the passing down of the tube into the deeper parts of the esophagus is a difficult procedure. To overcome this difficulty, I had to apply a new principle for the construction of the new model, the telescopic principle. By giving the esophagoscope a telescopic form, it is made possible to introduce the tube exactly in the longitudinal axis of the esophagus. Consequently, there is no pulling on the attachments of the esophagus and therefore comparatively little discomfort and danger to the patient.

I shall try to be as brief as possible in describing the instrument. It is rectangular and carries a mirror at the junction of the two arms for the purpose of light reflection. The horizontal part, which lies in the mouth, presents at its proximal end an illuminating arrangement somewhat like Brüning's. The telescope consists of six tubes, the diameter of which ranges from 10.5 to 15.5 mm. A long spring is soldered to the innermost tube, and with the aid of this spring it is possible to open the telescope to any required length and to close it after the examination is finished. A few small pins attached to the upper end of the tubes prevent this spring from protruding into the field of vision.

The uppermost tube presents at its lower circumference two metal guides which are of the greatest importance for the practical use of the instrument. These guides, acting as a kind of obturator, open the mouth of the esophagus automatically.

This leads us to the method of introduction of the esophagoscope. The patient sits in front of the doctor on a chair. You then ask the patient to bend his head slightly backward, and depressing the patient's tongue with the left index finger, the instrument is introduced blindly. As I said, the instrument glides in automatically and anchors itself in the esophagus. As soon as that is done, the patient puts his head forward into the normal position, which he maintains during the rest of the examination. You then push down your spring under the guidance of the eye

and so open the telescope. After the examination is finished, you pull on the spring, close the telescope and remove the instrument.

The mucus is aspirated through a rubber tube carried down to the bottom of the telescope. In order to give the tube its proper bend at the right angular junction of the instrument, it is guided through a metal tube with a kind of Albarran finger attachment.

Experiments for the construction of a forceps are still under way and have so far advanced that I feel assured of the possibility of constructing a forceps useful in every respect for this instrument.

I shall not take up your time with a detailed report of cases as most of them are reported in detail in the *Annals of Surgery* (1912). The view, inverted but not reversed, is a very good one. Dr. Chevalier Jackson, whose opinion in these matters is certainly authoritative, was kind enough to say at the recent International Congress in London that in looking through my esophagoscope he had as good a view as he ever obtained through any esophagoscopic tube.

The comparative merits of this telescope and the straight tube can only be decided on after my instrument has been in the hands of the profession for some time. The disadvantage of its complexity is to my mind fully compensated by the fact that its introduction causes much less discomfort to the patient, and owing to its construction, it is connected with much less risk.

I have accepted the invitation of your President to report to you about this new model with the greatest pleasure and hope that some of you will give this instrument a trial. I feel assured that the telescopic esophagoscope, though not meant to supplant the straight tube, will have a wide field of usefulness in esophagoscopic work.

DISCUSSION

Dr. J. C. Beck, Chicago: All that the doctor says is modestly expressed. I saw the pictures and saw the conditions. This is a picture of the esophagus that it is really a pleasure to see. Yet, the most important thing for us, as the doctor says, is yet in the shop—the instruments for removing growths and tumors for examination. For us the most important thing is the diagnosis of intra-esophageal growths, to make an earlier diagnosis and rule out neoplasms, and that work is done by the straight tube. This is certainly an ingenious instrument and we are very much indebted to him for bringing it here.

Dr. George F. Cott, Buffalo: The doctor is certainly to be commended for his ingenious instrument, but it will never replace a straight tube. It is practically a physical impossibility to work through that tube. For diagnosis, I think it is the best instrument we have.

Dr. H. L. Pollock, Chicago: I am sorry that I did not see the doctor present this most useful instrument. Its ease of introduction makes it

a valuable aid for diagnosis but I think it is absolutely impossible from a therapeutic standpoint. I do not think it can be made of practical use.

Dr. John W. Murphy, Cincinnati: I think the Academy is indebted to Dr. Lewisohn for bringing forward this ingenious instrument. I appreciate the ease with which it can be introduced. We all know that at times it is quite difficult and always very unpleasant to the patient to use the straight tube. The upper teeth are not infrequently damaged even by a careful and skilful operator. I can see how this instrument would obviate that discomfort and would add to the ease of the operator. I think the little device on the end for entering the esophagus is certainly ingenious, for we all know it is often quite difficult to enter past the cricoid, although Jackson and some of the more expert slip it in so it looks exceedingly easy. That can all be obviated by this ingenious instrument of Dr. Lewisohn. The principal drawback is that expressed by Dr. Cott. I think if any man can invent an instrument to work through this tube he is ingenious enough to cure the tumor without an instrument.

I wish to express our gratitude to Dr. Lewisohn for coming so far and showing his device, and as he continues his work along this line I am satisfied he will bring something forward that will be most practical and enable one less ingenious than himself to use it successfully.

Dr. R. Lewisohn (closing discussion): There is nothing impossible technically. When I started this work about four years ago, I went to different instrument makers, and they told me it was impossible to construct a telescopic tube. I then hired my own workman and put him in my shop to work on this instrument. The construction of the forceps has passed the experimental stage. I have the forceps in the shop and the forceps works. I need about two months more of work on it. I see the difficulties with this instrument based on its complexity as I see the difficulties of the straight esophagoscope. This instrument is not meant for a man who does a few hundred esophagoscopies a year, but for the man who does only three or four a year.

As for the use of this instrument on children, I have not started on that, but of course it would be very easy to have a smaller instrument. Furthermore, you could have three sets, carrying four, three or two tubes, respectively. It is unnecessary, for instance, to introduce all the six tubes when you know that you are dealing with an obstruction in the upper part of the esophagus. As I said, all these minor details have not been worked out. I hope that in a year or two you will hear more about this instrument.

TRANSACTIONS

OF THE

EIGHTEENTH ANNUAL MEETING

OF THE

American Academy of Ophthalmology and Oto-Laryngology

OPHTHALMOLOGICAL DIVISION

HELD AT
CHATTANOOGA, TENN.
OCTOBER 27, 28, 29, 1913

ADDRESS OF THE VICE-PRESIDENT—OPHTHALMIC SECTION

JOHN O. MCREYNOLDS, M.Sc., M.D.
DALLAS, TEXAS

Gentlemen of the American Academy of Ophthalmology and Otolaryngology: I must assure you in the beginning of my heartfelt appreciation of this unmerited honor I have received at your hands. I must acknowledge my gratitude, both to the ophthalmologic and otolaryngologic sections, for I am equally indebted to them and rejoice in their correlated growth and development. It would be unwarranted presumption, however, if I should take to myself all the credit of your kindness, for I know full well that you intend through me to express your generous esteem of that vast area of our country known as the South, and in behalf of the South I bring you her gladdest greetings. Indeed, it is an attractive feature of our profession that all artificial barriers are broken down and the universality of our purpose makes us one. The voice of science, like the language of music, is the same in every clime, and is understood and felt by truth-loving people of every land.

The Academy is essentially broad and progressive in its scope and feeling; it is not content with contributing to the countless joys that come to us through the powers of vision, but it studies with equal zeal the avenues through which we obtain the very air we breathe, the food and drink by which we are nourished and the production and the appreciation of the infinite series of sounds in the realm of speech and music. I would say to you that this Academy should appeal especially to the men of the South, where this combination of special practice is almost universal, and where every man is deeply interested in the joint achievements of both sections.

The scope of a chairman's work, I think, may vary within the widest limits and must be modified by circumstances and the material presented. The really important function is certainly not a formal array of personal achievements, but a marshalling of the good deeds of other men, by an adequate opportunity for the development of the entire membership in the fields of research and clinical experience; this duty does not necessarily demand a résumé of past and published work, but a presentation on the

program of the living work of the hour. It is not a history or compendium of the established results, but a stage on which the makers of history present in vivid review the best labor of their lives. Thus also it is not a museum of interesting fossils and bird eggs and relics, but rather a great laboratory of thought in which the experiences and deductions of men are tested in the crucible of keen, kind, conservative and convincing criticism. It is a laboratory in which errors are precipitated and filtered off from the perfect and permanent fluid of truth. It is a laboratory in which all are students with a common aim and are united by the bonds of a common interest. It is a laboratory in which the highest respect and the deepest reverence are felt toward those mighty pioneers of the past whose spirits strode like giants through the gray dawn of scientific developments. And yet it is a laboratory in which methŏds and results rather than dogmatic authorities control the trend of effort and establish the equal right of merit wherever found; it is a laboratory that gathers its inspiration from the glory of fruitful toil and rejoices in the fullest freedom of its faith and in the world-wide democracy of our profession.

These, gentlemen, I believe are the dominant ideas of this Academy, and on these cardinal principles will be wrought out the richest results and the most enduring destiny.

But, gentlemen, I should forget a most pleasing and important part of my privilege to-day if I should fail to say a few words of welcome to our distinguished guest, Lieut.-Col. Elliot of London and Madras. And, in advance, I should acknowledge the generous consideration extended by the otolaryngological section in allowing us for two years in succession the opportunity of inviting as our honored guest some man whose chief contributions have been to the science and art of ophthalmology. But I feel that I would correctly represent the views of the ophthalmologic section when I say that we shall be delighted to return in the future the compliment, in full and without reserve.

I must also express to our friend and colleague Colonel Elliot our deep appreciation of this honor his coming has shown to our profession in America. Those of you who were present at the Oxford Congress of Ophthalmology and the International Congress of Medicine in London will all agree that our distinguished guest was easily the center of attraction among the assembled oculists of the world, and that his modest demeanor and unfailing courtesy threw a new splendor over the laurels his merit had won. I must plead guilty to having represented an

American visit to him, while in England this summer, in the most roseate hues that I could possibly imagine; and, while I could not promise that we could surpass the beauty and charm of his native isle, I felt that I could safely assure him of the warmest welcome American hearts could give. But, may we not claim Colonel Elliot as a typical American? Is there any trait of the ideal American type more essential and more characteristic than his own broad catholicity of spirit that knows no North, no South, no East, no West—not even the limitations of land or sea? And, then, are we not all ourselves Englishmen, transplanted in the Western world? It is true that our blood has been enriched by the mingling of the strains from all over the world, but the final foundation stock, whether puritan or cavalier, on which we have built up the sturdy structure of American citizenship, came after all from Merry England. The old mother country still lives in her children, and the throbbings of her old heart are still felt throughout our land from ocean to ocean. The warm currents of her blood are coursing through all of our institutions, and have fashioned the very form and fiber of our laws. It is a hopeful promise for the peace and prosperity of the world that the English-speaking people, now encircling the globe, are united in the one great purpose of bringing health and happiness to every home.

Let this union grow stronger in every phase of our civilization till triumphant truth and the brotherhood of man shall cover the earth with their glory.

PELVIC REFLEXES *

GEORGE R. WEST, M.D.
CHATTANOOGA, TENN.

I feel much honored by your kind invitation asking that I address this distinguished assemblage on this auspicious occasion. It is indeed a happy omen, one full of good meaning and liberality of thought, that prompts you to ask one outside of the pale of your several specialties to contribute his own views as bearing on your individual fields of endeavor.

For this purpose I have selected the subject "Pelvic Reflexes" as a worthy study of convincing interest and one guiding the way to the diagnoses of some apparently obscure conditions, which ordinarily might perplex and confound the attending physician.

Before entering on those thoughts most germane to your several specialties, I will ask a moment's patience, while I briefly announce in a general way some salient points pertinent to the subject of (1) reflexes in general; (2) those that manifest themselves at puberty; (3) during pregnancy, and (4) at the menopause.

I cannot consume your time, nor would it be desirable to reiterate the anatomic data and physiologic facts concerning the subject of general reflex action; suffice it to say, that the relations and interrelations between the cerebrospinal system and the sympathetic nervous system are so commingled and intercommunicating that disease of one organ may produce a simple reflex action or may be a pathologic process in an organ remote from the site of the primary affection, and presenting in not a few instances a clinical picture of paramount significance. To illustrate, allow me to call your attention to the phenomenon occurring when a brilliant light is suffered to fall on the retina of a hay-fever victim. At once the end-organs of the sensory nerves supplying the area affected, being oversensitive to this form of stimulation, become overexcited and, transmitting the impulse to a sensory center, the impression is translated into a motor impulse, which impulse manifests itself in a double phenomenon. Two pathways are now involved in completing the nervous circle; the vasomotor control of the blood-vessels of the affected area is interfered with, resulting in dilatation, engorgement and swelling, while involve-

* Read by Invitation.

ment of the vagus and the sympathetic nerves to the muscles concerned in the act of sneezing may also include the sympathetic nervous mechanism of the whole respiratory tract, resulting, as is so often the circumstance, in sneezing, lacrimation, wheezing, coughing, etc.

Again, as a general reflex I refer to the midorbital pain, often the result of affections of the nasal mucous membrane, the stomach, heart or apices of the lungs. Diseases of the uterus often produce reflected pains to the lower part of the back, but do not produce headache; while ovarian diseases may cause pains to radiate down the thighs and even into the feet, as well as cause hyperesthetic areas over the body and head. Of the pelvic reflexes manifested at puberty I have little to say at the present moment, because of their intimate association with a number of diseases and affections to be subsequently reviewed. Nevertheless, a word relative to the subject of menstruation seems opportune. This great physiologic epoch in the woman's life is inseparably connected with many curious reflex phenomena, which are preceded by exalted psychical, emotional and reflex action. The great reflex sensibility of this period is well illustrated in peculiar symptomcomplex shiverings, followed by sensations of heat, yawning, heaviness of sleep, stiffness in the neck, anorexia, hoarseness, hiccough, etc.

Marked changes are likewise noted in the tension of the vascular system. Great vascularity of the skin, vicarious hemorrhages, as may be seen occurring from the nose, mouth, conjunctiva, nipples, etc. During this period the entire glandular system undergoes exalted tension, as exemplified in the swelling of the breasts, which become tender and sometimes painful and may exude a drop or two of serum from the nipple. Pigmentation is also excited, and is mostly evidenced beneath the eyes and on the nipples and genitals.

The marked changes in the maternal system during pregnancy must of necessity be productive of wide-spread reflex and sympathetic disturbances. Chief among these may be mentioned nausea and vomiting; certain alterations in the nervous system, including a change in the natural disposition of the woman, the morbid cravings for strange and disgusting articles of diet, neuralgic pains, toothache, perhaps epistaxis, intense cramps in the extremities, and possibly the presence of Beccaria's sign (a severe pulsating pain in the occipital region). The glandular system likewise shares in these peculiar disturbances. By the second month the breasts have begun to enlarge; usually pigmentation is deposited

in the areola of the nipple, together with enlargement of the glands of Montgomery. A peculiar glandular reflex in the pregnant woman is the increased functional activity of the salivary glands and the production of great quantities of a watery secretion. In this extremely brief survey of an all-important subject, I may add that at that critical period of a woman's life, known as the menopause, the pelvic reflexes manifest themselves in a group of nervous phenomena, characteristic flashes of heat, alterations in the disposition and in the physical constitution, sometimes epistaxis, and a tendency to obesity.

These tabulated facts would seem to confirm the rôle played by the so-called internal secretions. Thus, in the operation of ovariotomy after complete extirpation of both ovaries, there are frequently evidenced extreme nervousness, changes in the woman's disposition, and a tendency to obesity. Very likely the adipose deposit is due to a diminution in oxidation, as shown by Loewy and Richter, that ovariotomy in dogs results in a marked decrease in physiologic oxidation as measured by the quantity of oxygen consumed.

With these few words I would invite your consideration of pelvic reflexes in relation to affections of the throat and nose. And, as an introduction, we are at once impressed with the close relation between the sexual system and the innervation of the larynx as shown in the soprano voice of the castrated male. Notwithstanding the assertions enunciated from time to time that the testicles elaborate an internal secretion that regulates the quality or character of the voice, the memorable studies of Brown-Séquard and a coterie of distinguished followers have failed absolutely to offer confirmatory evidence of this statement. The only positive facts deduced from a critical study of testicular extracts in the past twenty years seem to conclusively prove that this fluid possesses marked stimulating action on the neuromuscular apparatus and increases the power of doing muscular work, and that a definite chemical substance named "spermin," which may be obtained from the extract, apparently exerts a tonic effect on body metabolism.

This latter factor may account for the short horns and thin, scraggy neck of the castrated bull-calf. But, from all deductions concerning internal secretions, the peculiar low of this unsexed animal, like the soprano voice of the castrated human male, has not been demonstrated in fact. Previously, I referred to the much stronger evidence that an internal secretion is elaborated by the

ovaries, but scientific proof seems lacking to offer any deductions of a positive and convincing nature, such as we have in the case of the thyroids and adrenals. Now it is a familiar fact that in soprano singers, the occurrence of the menses is accompanied by huskiness of the voice, and Doro, an Italian physician, reported some years ago a case in his gynecologic practice that arrested much attention at the time of its publication. A gifted opera singer sought his professional advice in regard to a displaced uterus, associated with marked pelvic congestion, from which she had long been a sufferer. Under skilful treatment this cantatrice was restored to normal health and was enabled to reach the higher notes in several arias that before this treatment were impossible of attainment. C. H. Leonard[1] has reported several cases, in which voices impaired by uterine disease had been restored, remarking that in the case of one singer, two full notes were added to the upper register of a high mezzosoprano, as a result of treatment directed to an antiflexed uterus, with endometritis and narrowing of the canal.

In further corroboration of pelvic reflexes as affecting the larynx and vocal cords it is interesting to mention a peculiar condition of the mucous membrane of the upper air-passages invariably caused by a pathologic condition of the female pelvic organs, and which is neither an anemia nor a congestion. The mucous membrane of the larynx and pharynx presents a bluish, reddish hue. The mucous membrane itself appears relaxed and doughy, with a slight enlargement of the follicles. The vocal cords present a peculiar muddy appearance, are relaxed, and apt to flutter during the production of the low notes. To this group of characteristic symptoms the late Carl Seiler applied the term uterine reflex laryngitis. In support of his statement, I quote these words:[2] "To be able to make this apparently hazardous assertion without hesitation, I secured the kind cooperation of my friend, Prof. Howard A. Kelly of Johns Hopkins University, who bore me out by vaginal examination in every instance. In a number of cases which we examined conjointly for the purpose of establishing the truth of this statement, either the laryngoscopic or vaginal examination was made first and the diagnosis written down, sometimes several days before the other examination was made, either by Dr. Kelly or myself, and it was astonishing how closely I was able to diagnose intrapelvic disease; and I

1. Quoted by S. S. Bishop: Diseases of the Ear, Nose and Throat.
2. Seiler: Diseases of the Throat.

have found that when the condition referred to is more pronounced in the larynx and pharynx, the cause is intra-uterine, while if it is more apparent in the upper pharynx and nasopharynx the cause may be looked for in the ovaries or tubes." Seiler maintains, and the assertion finds acceptance, that the peculiar condition of the vocal cords in this affection as just described explains the existence of the well-known harsh voice of the wanton woman of the street.

Before reviewing some of the interesting reflex conditions and neuroses found in the nasal cavities, it becomes us to take a brief survey of a few anatomic data in relation to the nose that have a direct bearing on the subject under consideration. In brief, the nerves of the nose are of two kinds; those of special sense and those of general sensation. The former consist of filaments from the olfactory bulb; those of general sense are offshoots of the trifacial. I shall not lead you through an anatomic labyrinth, save to say that impressions are transmitted to the brain and also through various ganglia to all the nervous pathways; sensory, motor, sympathetic and special sense. Irritation can be carried to the brain through the motor, vasomotor, secretory or sensory tracts. Through the brain the olfactory nerve is brought into relation with the entire system; while the trifacial is in connection with three ganglia, the most important of which is the ciliary, whose point of origin in the medulla is in direct communication with all the other motor fibers coming from that division of the brain. It is, therefore, from these correlated anatomic facts that disease in distant organs so frequently gives rise to nasal affections.

As early as 1843, Müller, the celebrated physiologist, defined the connection between distant organs as a distinct reflex, with the pronouncement that irritation of any mucous membrane could give rise to a respiratory reflex. And it was Voltini who in 1871 gave utterance to the statement that the nose was the definite point of origin of many and varied reflexes.

Scores of distinguished names enrolled in the annals of science during the past forty years, attest to the searching inquiry made into this fascinating study. A discussion of these theories would be irrelevant in an exposition as brief as this. Suffice it to remark, that there is apparently a close sympathetic relationship between the erectile portions of the generative and pelvic systems and the other erectile structures of the body.

It is an accepted fact that excessive coition may give rise to reflex cough, and systematic writers include this as an etiologic

factor in the production of hay-asthma, designating it the "erotic" form.

Grayson[3] reported a case of sexual excess in a man leading to nasal obstruction in association with hypersecretion, sneezing and headache. Treatment was unavailing. Eventually the true cause was ascertained and corrected, the patient immediately getting well without further treatment.

Mackenzie[4] reports a similar case in a young woman, the associated reflex symptoms being asthmatic breathing and closure of both nostrils. Again, the cause was discovered and with its withdrawal the patient's annoying symptoms at once subsided.

As has been previously announced, the menstrual flow is often associated with huskiness or roughness of timbre of the voice, so also it is not infrequently coincident with swelling and engorgement of the turbinate tissues. The studies of Fliess would tend to prove that abnormality of the menses may at times find its etiology in intranasal disease, and he urges that the pain in certain forms of dysmenorrhea may be abated by the application of cocain to the nasal mucosa or perhaps completely cured by the employment of cauterization. Before concluding this portion of the paper, I wish to say that frequent nosebleed in boys at puberty may be dependent on a sexual cause.

A study full of interest and carrying importance of the first magnitude are the causative factors of affections of the eye dependent on pelvic conditions.

As the physiologic action of the generative system is inactive until puberty, it must be very rare indeed to find ophthalmoscopic symptoms in any way referable to the pelvic region. At the menstrual epoch, however, the bodily functions become powerfully influenced by this great crisis and many abnormal manifestations in ophthalmologic practice are ascribed to pelvic and generative changes. In boys, however, these reflexes are much fewer and much less common. Thus, Gowers[5] asserts that in chronic menstrual irregularities, optic neuritis of chronic course has been found, and occasionally other disturbances, such as retinal hemorrhages. Kollock[6] recites a series of cases where, besides asthenopia, ocular pains, etc., which occurred during female puberty, retinochorioiditis appeared. Thaon[7] records a pronounced case of

3. Trans. A. M. A. Section Laryngol., 1897.
4. Johns Hopkins Bull., January, 1893.
5. Gowers: Medical Ophthalmology.
6. Gaillard's Med. Jour., June, 1888.
7. Trans. Ophthalmol. Soc. of the United Kingdom, 1888.

neuroretinitis "with numerous white patches along and superadjacent to the vessels." Vision was abolished in the upper third of the field. Treatment directed to the restoration of the menses eventually resulted in cure. Derby[8] offers a typical case of monocular neuroretinitis in a girl of 12 who had never menstruated, he asserting that "the optic neuritis apparently bore some relation to the efforts of nature to establish the catamenial period," which seems more than probable. In some patients profuse intraocular hemorrhages appear and reappear at every catamenial epoch. A curious phenomenon is the occurrence of amaurosis as a result of menstrual suppression, which disappears immediately on the return of the menstrual flow. This transient interference with vision has frequently been recorded.

In passing it is curious to note that there exists at about the period of puberty a concentric narrowing of the field of vision both for form and color which is greatest during the height of the menstrual epoch. This may be associated with the faulty perception of yellow for green, with a slight decrease of central vision without a change in refraction.

With increase in age the eye may suffer many pathologic processes from pelvic abnormalities, the merest mention of which will well serve our purpose: Chief among these which I refer to is anesthesia of the retina, which is a very complicated neurosis, with a peculiar contraction of vision, rapid disappearance from view of any object that is being fixed, visual hallucinations, inability to read for any length af time, weariness of the eyes and eyelids, perhaps intolerance to light, etc. Most patients thus affected are women, in the majority of cases sufferers from ovarian or uterine trouble, more so than from chlorosis. These are the patients who, instead of being directed to the gynecologist, are placed under the care of the neurologist for the treatment of neurasthenia, which of necessity must be unavailing.

There remains but to mention briefly those diseases of the eye which among other causes may be reflexly influenced by pelvic derangements: Of the sclera, we encounter episcleritis, scleritis of the deep variety and sclerokerato-iritis. Of the vitreous humor we may have opacities. Then, again, we find hemorrhagic retinitis, especially if menorrhagia be present, the occurrence of papillitis, of orbital optic neuritis and lastly a disturbance of the normal balance of the external muscles of the eye.

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8. Trans. Amer. Ophthalmol. Soc., 1888.

The subject of pelvic reflexes—and possibly you share my opinion—is a tempting one, but in the brief period allotted I have merely been able to touch, as it were, on the hem of the garment in this flighty fashion. But sufficient data have been introduced to show the mutual dependence of specialty to specialty and to warrant the assertion that none of us can work independently of the other, if we would advance, each of us, the single department that in the aggregate commands the mighty superstructure to which we have dedicated our lives. Gentlemen—members of allied interesting specialties—for the privilege of reading this paper, I thank you.

CORNEO-SCLERAL TREPHINING*

LIEUT.-COL. R. H. ELLIOT
MADRAS, INDIA

Mr. President and Gentlemen:—I am deeply conscious of the honor you have conferred on me in inviting me to address you here to-day, and I have felt that it would be unworthy of the occasion to give you merely a résumé of previously published work. A little more than four years ago (Aug. 9, 1909) I performed my first trephinings for glaucoma after a long period of indecision as to the justifiability of the proceeding. The very first morning's work not only convinced me that I had been right in giving the operation a trial, but sent me from my theater deeply impressed with the value of the new procedure. I was unaware then that others had long anticipated me and that "trephining for glaucoma" had been on its trial while I was still a schoolboy. This was well for me, for it left me free to work out my own technic unfettered by doubts and fears. The object that I then had before me, and which I have consistently kept before me ever since, was to tap the anterior chamber with a minimum of surgical violence and permanently to draw away the fluid of that chamber through the efferent channels of the subconjunctival space. Iridectomy enters into the procedure exactly as it does into that of the combined operation for cataract. In other words, it is a necessary evil, but fortunately an evil which can be reduced to a practically negligible quantity. Professor Axenfeld has challenged my statement that the iridectomy is of no value in the operation and that it enters into trephining just as it does into the operation for cataract. I would reply that though I now perform an iridectomy as a routine step in my operation, I formerly used to omit it. In a large number of these simple operations I established free filtration and relieved the glaucomatous condition without touching the iris. I was led to include iridectomy in the way I now do by finding that from time to time the iris in the neighborhood of the wound bulged and closed it.

Professor Axenfeld further points out that trephining relieves a number of cases of glaucoma in which no evidence of permanent fistulization of the eye can be obtained. Now this criticism brings

* Oration on Ophthalmology.

up a point of the utmost importance. I have often been shown successful cases both in Europe and America in which the surgeon was satisfied that fistulization had not been established, and as proof of this contention the flat condition of the conjunctiva was pointed out to me. This appearance, in the opinion of my critics, negatived the idea that filtration was taking place. Such an idea is based on a misconception. It is not necessary that we should be able to point out a raised pad of filtering tissue. Filtration often occurs in a conjunctiva that appears to be flat and unaltered. If, however, you will take a spatula and press over the neighborhood of your wound, you will frequently find that free filtration is taking place. The evidence of this is the pit made by the spatula. It is just as evident to the eye as the pit made by pressing the thumb over the edematous shin-bone of a patient with a renal cardiac trouble. I lay especial stress on this point, because I have demonstrated this maneuver to first-class surgeons both in Europe and America, and they have told me that they had never grasped the significance of it before, although they had carefully read my book. It is no imaginary or mythical idea. It is a test that you can apply easily and quickly and one for which you seldom require to use a local anesthetic.

Every effort has been made to avoid interference with the ciliary body, and in consequence the site of trephining early crept forward till the operation has become a sclero-corneal, or even a corneo-scleral procedure.

Despite my personal conviction of the value of the technic I have advocated, a conviction which now rests on the carefully taken records of 900 consecutive cases, I was far from feeling confident that the method would be widely adopted until after the lapse of many years. This pessimistic forecast rested largely on observation of the way other procedures of undoubted value have often been received by the medical profession, and was certainly strengthened by some of my earlier experiences. I should be remiss, indeed, were I to forget to acknowledge the generous assistance I received from the very first at the hands of the editor of the *Ophthalmoscope*, who has placed me most deeply in his debt by the way in which he has treated me from the outset. His columns have always been open to me, and it has been through their medium that nearly all my work has found light. Even then my fears might have been realized but for a force with which I came in contact for the first time at the Oxford Ophthalmological Congress of 1911. That force was and is American ophthalmologic

opinion. I desire to take this opportunity of acknowledging before what I understand is the largest society of experts in the world my abiding debt to the ophthalmologists of your great country for the reception they have accorded to my work from the outset. It has mattered nothing to you that I came from one of earth's Nazareths, 7,000 miles away from London, or that my name was comparatively unknown to you. Your wonderful receptive capacity warned you that there might be the germ of an important discovery in the work, your large-hearted generosity bade you examine it simply on its merit, and your critical acumen has placed an endorsement on it of which I am more than proud, and which has had no small share in establishing corneo-scleral trephining as an accepted procedure throughout the civilized world.

When I first determined to bring out a book on the subject my friends seemed astonished that there could be material to fill such a monograph. To-day, as my publishers are calling for a second edition, the difficulty that presents itself to my mind is that of selecting the material for the new volume without giving offense by the exclusion of matter which others might think should be included. Already this difficulty has been met with in the first edition, but since the appearance of that edition, now nearly six months ago, so much work has been done by others, so many new modifications of technic have been put forward, and such a variety of criticism and suggestion has been offered that I feel deeply the magnitude of the task that lies before me in endeavoring to answer my questioners; and, if I may venture to say so, to keep the technic from being diverted from what I believe to be sound lines and to preserve the still young method from the chilling blast of criticisms of which it will easily dispose, if time be given it to attain the full strength of its manhood, but which are all too dangerous for it at present. And here let me say that I welcome criticism and have always done so. That with which I have met has always been fair, thoughtful and enlightened, and though time and experience has very satisfactorily answered most of it, it has done nothing but good.

In the early days we were told that trephining would make an eye too soft and so interfere with its nutrition; that the trephine hole at the limbus would speedily fill up and tension would thereby be allowed to reassert itself, that corneal tissue would, if cut, proliferate and promptly fill up the aperture made in its substance, that the tissue dissected up from the surface of the cornea would inevitably become sealed down again, thus closing this area to

filtration and effectually blocking the trephine hole. Four years of experience have dealt effectually and firmly with all these criticisms. The photographs I showed at Oxford, and which were also published in the *Ophthalmoscope,* have, I think, proved most conclusively the permanence of the hole made in the corneoscleral tunic. I have seen just as conclusive evidence in Cheltenham, London and elsewhere.

We need not enter into theoretical discussions as to the question of whether a permanent fistulous hole can be definitely established in the tunic of the eye. We have but to look and we can see it for ourselves. In cases where the couch of filtering fluid is thick we may need first to press gently over the trephined area, in order to express the filtered fluid, and then through the thinned covering layer we can see "the hole" for ourselves. Here let me pause and explain that when the hole *does* fill up, and (as I have always admitted) such a filling up is one of the causes of our failures, the black round hole disappears and its place is taken by white or greenish tissue, quite different from the original black circle in appearance. No longer is the clean round 2 mm. hole present; its place is taken by a puckered contracted scar. With this anatomic change, the clinical sign of filtration has disappeared. Hitherto I have spoken from clinical grounds alone, when I have put forward the above views. The work recently done by Mr. Stephenson on some of our Madras failures has proved up to the hilt the views founded on clinical observation. This valuable work will shortly be before the profession, and I am deeply indebted to Mr. Stephenson for allowing me to make use of it as he has done. We hope, however, to take this work much farther in the near future. So much for past criticisms which I have had the opportunity of answering elsewhere. I now propose to take up some of the more recent criticisms and suggestions for technic. I think and hope such a course will be in accordance with the wishes and pleasure of your Academy.

I shall begin with the much-debated question of the flap, for I look on the correct formation of the flap as the critical step in the whole procedure. Mr. Teacher Collins, who, if I understand him rightly, was at one time doubtful as to the possibility of the establishment of permanent fistulization by means of trephining, gave his view on this subject before the International Congress, and put the case with his usual lucidity. He pointed out that there are three essential factors in the formation of the filtering cicatrix:

1. That there must be a permanent gap in the endothelium of Descemet's membrane.

2. That the margins of the wound in the cornea and sclera should be kept antiseptic and constantly bathed by aqueous humor.

3. That an extension of the surface epithelium down the lips of the wound must be prevented by removing the opening in the sclero-corneal tissue as far as possible from that in the conjunctiva.

He went on to say that "the operation of trephining devised by Colonel Elliot seems excellently to meet these three essentials. By the removal of a circular piece of Descemet's membrane a gap is formed in its lining endothelium which it is difficult, if not impossible, to subsequently bridge. The substantia propria is then left permanently exposed to the aqueous humor, and by making a large conjunctival flap any risk of extension of the surface epithelium down into the wound in the fibrous tissue is avoided. It is, of course, most desirable that no buttonhole should be made in the conjunctival flap. This, in my experience, is one of the most difficult points in the technic of the operation."

It is of interest, at this point, to turn aside to consider what we actually do when we "split the cornea." I have for a long time believed and taught that one is more likely to obtain good filtration from the corneal area if one tears rather than cuts the tissue in the course of this dissection. The impression conveyed to me clinically was that in this way one opened up the spaces of the tissues rather than cut through their layers. It seemed likely that this would favor the subsequent drainage. Just before I left London, Mr. Sydney Stephenson showed me a series of very valuable and instructive sections which he had cut from eyes sent home from Madras and in which failure had followed trephining. It was quite clear from these that the flap consisted not merely of the surface epithelium and Bowman's membrane, but that it also included, as we had long believed, the superficial layers of the cornea. The fact that these laminae had been dissected up was very evident. There had in fact been a true splitting of the cornea along its interlamellar spaces. I venture to lay a little special stress on this point because, in my opinion, it supports the view I have so long held on clinical grounds that we should endeavor to tear rather than to cut when conducting our splitting of the cornea. I have read with much interest Dr. Wallis' thoughtful paper in the current number of the *Ophthalmoscope,* in which he advocates the corneal splitting being performed "in three or at most four strokes" of a Desmarres knife. I do not attempt to

dogmatize, but I am disposed to think that this method is inferior to that which I have recommended, and I suggest the possibility that the cases of failure which he records when the trephine hole was placed entirely in the cornea may be really done by the cornea having been cut and not split. For we have obtained good filtration in Madras when practically the whole of the trephine rested on corneal tissue. At the same time, I am speaking largely from clinical observations, and I earnestly invite the members of the Academy to devote some of their attention to this question in the future.

I next pass on to discuss the new sliding flaps which have been advocated by Von Mende, Duprey-Dutemps and some American surgeons. These flaps differ from mine in that the conjunctiva is in them detached from its connection with the limbus. Rightly or wrongly I feel that this is a very serious mistake. I speak with the greatest deference for the opinions of such distinguished surgeons and I recognize clearly that in a question of difference of opinion they are at least as likely to be right as I am. But, on the other hand, I feel that a very important principle is at stake, and I believe that those who adopt the modified flaps of these writers will not find the same satisfaction from trephining as those who keep to the flap I have advocated. I trust, therefore, that those who differ from me will pardon me if I put the case as I see it.

1. In all such flaps there is a breach of surface of the conjunctiva, in the immediate neighborhood of the trephine hole, whereas in my flap the hole is separated from the surface epithelium by the whole breadth of the conjunctival flap: (*a*) There is thus not the same danger in my technic of the epithelium growing into and plugging the hole; (*b*) the danger of sepsis is obviously greatly decreased, and (*c*) the likelihood of early union of the flap to the deeper parts, and therefore of the early reestablishment of the anterior chamber is much increased when there is a broad flap between the exit of the fluid from the interior of the eye and the edge of the flap, as compared to the condition in which that edge lies close to, if not actually in contact with, the hole.

2. In all these flaps the anterior edge of the trephine hole must (I think) heal up to and be part of the boundary of the edge of the flap. Even if, as in Von Mendes' technic, the surface of the cornea is freshened to allow adhesion between it and the flap, it seems obvious that the flap will heal down to the cornea right up to the anterior edge of the trephine hole. If you will examine

eyes in which the cornea has been split according to my technic, you will find that the case is quite different. The corneal filtration area extends anteriorly beyond the trephine hole, and there is a distinct area of separated and filtering corneal flap on the pupillary side of the trephine hole. My flap is made by splitting the connective-tissue planes and flushing those planes at once and permanently with aqueous fluid. There is, therefore, no reason why a cicatrization in the neighborhood of the hole should take place. In any case, it does not take place in the majority of cases. I look with apprehension on a method which necessarily introduces plastic tissue up to the very margin of the hole we wish to keep patent, and I greatly prefer my own technic, which not only avoids this danger, but in addition gives one the possibility and indeed the probability of a much wider filtering area on the cornea itself. In connection with this point, I should like to say that it looks as if the escaping fluid actually dissects up the intracorneal space made by the splitting. It at least takes advantage of all the dissection that has been made. I say this because one endeavors always to utilize every fraction of a mm. of one's splitting of the cornea, by sliding the trephine as far forward as possible before commencing to rotate it, and yet one constantly finds the filtration area extending beyond one's trephine hole.

3. The flaps we are discussing may retract and leave the trephine hole exposed, an accident which I should think must cause the operation to end in failure, while such a thing cannot happen with my flap, at least it has not yet happened in 900 cases; and I fail to see how it can ever happen, for if the flap does not unite and is found rolled down at the first dressing, one can at once use sutures and fix it firmly and certainly in its place, thus absolutely putting out of court the possibility of the danger we are discussing. Time and the experience of others will show whether we are wrong in anticipating that retraction of the flap and exposure of the trephine hole is a real danger. I freely admit that my objection to it is based on theoretical grounds and I shall await the ultimate verdict with an interest unclouded by any feeling of bias. I desire to make it very clear that I am far from resenting criticism or modification of my technic. I welcome both, leaving time and experience to be the assessors.

Much has been made by some writers of the difficulties of my technic and to meet those difficulties many suggestions have been made.

M. Duprey-Dutemps suggests his sliding flap because my flap, when turned down over the cornea, obscures the field of operation and renders it difficult, as he says, to recognize the exact spot at which the trephine should be applied. I would first point out that M. Duprey-Dutemps advocates trephining at or behind the limbus, and that he thereby gives away the most important element of my technic, namely, the placing of the trephine as far forward as possible onto the cornea. Apart from this another point arises: If the surgeon is content to trephine at or just behind the limbus, as I did in my earliest operations and as M. Duprey-Dutemps does now, he should find no difficulty with his flap made according to my technic. In those days I found I could complete a trephining operation in five minutes, and I have done six of such operations in half an hour. I can think of no easier procedure. It is when one comes to split the cornea that the real difficulty, such as it is, begins. The objection that one cannot see the exact spot at which to apply the trephine is not, to my mind at least, a valid one. One desires to trephine *as far forward as possible*. One therefore splits the cornea as far forward as one safely can and, utilizing every fraction of a millimeter of the space so gained, one places the trephine on the sclera and then slides it up to the angle of the flap as close as one dare do, consistent with avoiding the making of a buttonhole therein. The dark crescent of exposed cornea and the angle of reflection of the flap show the operator clearly where he is. He needs *no other landmarks*. If he differs from me in not holding this opinion, he can act on Mr. Wallis' ingenious suggestion to "hold the flap lightly and almost at right angles to the cornea . . . in this way," he explains, "the anterior chamber is not obscured from view."[1]

Von Mende goes further than Duprey-Dutemps. He desires to make a sclerocorneal trephining. He makes a sliding flap to cover it, and he abrades the corneal epithelium for the purpose. I suggest that he will not get corneal filtration, inasmuch as it seems likely that the flap will firmly adhere to the abraded cornea. At least that is what one has seen happen in other operations in which the cornea is so abraded for the reception of a conjunctival flap. I further fear that the cicatrization of this flap to the anterior half of his trephine hole may lead to obliteration of that hole, owing to proliferation of the connective tissue in question. If the scraping of the corneal epithelium is omitted it would seem likely that the conjunctival flap will only take hold around the

1. Ophthalmoscope, October 1913, p. 591.

anterior half of the trephine hole. Apart from the dangers of introducing a proliferable tissue in the fistula, is such a hold strong enough?

Are the difficulties these modifications of technic have been designed to meet real? I can only say that I have taught some twenty to thirty pupils to trephine in Madras and that the acquisition of the necessary skill appeared to come very easily to most of them. I do not now call sclerocorneal trephining an easy procedure, but it is certainly one which is well within the powers of any surgeon with good eyesight and skilful fingers. I look on the new modifications as retrograde steps. I have combated them thus strongly because I feel that in its present period of trial the operation requires to be protected. At the same time I desire to do or say nothing which can hurt the feelings of the ingenious and illustrious surgeons who are responsible for these modifications.

LATE INFECTION OF THE EYE AFTER TREPHINING AND DELAY IN THE REFORMATION OF THE ANTERIOR CHAMBER

At the International Congress last August in London, I was asked if I had met with or could explain cases in which late suppuration occurred weeks or months after trephining. The prevalent explanation seemed to be that organisms accidentally imported into the conjunctival sac had found their way through what was described as "*the thin conjunctival covering* of the trephine hole" into the interior of the eye. Now, I venture to doubt such an explanation. It is difficult to believe that organisms would penetrate this flap, *so long as the conjunctival epithelial layer remained undamaged,* though if once the epithelial covering were abraded infection might easily be conceived as likely to take place. There is, however, another possible route for infection in some cases, namely, through a tiny leaking fistula in the perimeter of the flap. This is a matter of so much importance that it deserves careful consideration. Mr. Wallis in his interesting paper on "The Restoration of the Anterior Chamber after Elliot's Operation,"[2] discusses the possible and probable causes of non-restoration or delayed restoration of the anterior chamber after trephining. He is inclined to consider a diminution in the secretory power of the ciliary body a contributory factor, but he lays most stress on the depth of the chamber before operation, believing that when this is very shallow we may look for delayed healing, and vice versa. The question of delayed restoration of the chamber long ago

2. Ophthalmoscope, October 1913, pp. 594-596.

attracted our attention in Madras and led to a discovery as important, from the point of view of treatment, as it is interesting from a purely academic standpoint.

It is first necessary to premise that two distinct conditions are involved, namely, (1) a leaking chamber, and (2) a soundly closed chamber, into which the relaxation of the lens ligament and the pushing forward of the ciliary body permit and invite the lens and iris to project. It is to the latter class that Mr. Wallis' attention has evidently been directed. I shall discuss each in turn.

1. *A Leaking Chamber.*—When the chamber remains shallow for days or even for a longer period after operation, the eyelids should be widely opened, under cocain if necessary, and the whole length of the scar of the conjunctival flap exposed by asking the patient to look strongly downward. An absorbent wool sponge, squeezed out in sterilized water, is next used to dry the conjunctiva by gentle dabbing at spot after spot along the course of the incision. In doing so the cause of the shallowness of the chamber will not infrequently be found in a tiny leak which can be seen taking place from under the flap onto the surface through a tiny fistula which owes its origin to the fact that at one point the lips of the incision have failed to unite. Naturally under the circumstances the chamber cannot fill. The leak is too rapid for the established rate of secretion. The remedy is extremely simple. In Madras we are always on the look-out for such cases, and as soon as the cause is recognized we touch the leaking spot with a sponge wet with a solution of silver nitrate (gr. x ad ℥). The result is an immediate closure of the leak and a concomitant filling of the chamber.

2. *A soundly closed chamber, which was shallow before operation,* may remain shallow thereafter, as Mr. Wallis has justly observed, and I believe that this is, as he thinks, a question of cause and effect. But there is more in it than this. If the shallowness of the chamber is due to the acuteness of the preceding glaucoma trephining restores the natural depth as soon as the conjunctival flap seals the aqueous fluid off from external escape. But if the shallowness is due to the fact that a long-standing glaucoma has overstretched the diaphragm of the eye, we cannot expect that the reestablishment of the aqueous current will overcome the mechanical deformity there occasioned. And, indeed, this mechanical factor constitutes the greatest menace to the success of any operation for late glaucoma, for it permits of the dislocation of the lens into the wound. I have in Madras a beautiful

specimen illustrative of this accident occurring after trephining and I doubt not that all of us who have large operative experience will remember similar accidents having occurred after iridectomy or after Lagrange's sclerectomy. The specimen I refer to shows plainly that the accident was made possible owing to overstretching of the ligament of the lens. The too mobile lens evidently followed the path of least resistance and therefore moved forward to the trephine hole and so became impacted therein. I am inclined to attach little weight to the question of diminished secretion as a factor in reformation of the chamber, as indeed does Mr. Wallis himself. There is little if any evidence to support such an idea and some at least could be brought against it. Nor do I think that, provided the above line of argument is accepted, the proposal made by Mr. Wallis to perform a posterior sclerotomy as a preliminary to trephining would prove effective. Nor can I agree with the proposal to keep a patient in bed for some days after trephining until the chamber is fully restored, a piece of advice based on the assumption that the temporarily disorganized ciliary body does not secrete sufficiently; whereas, such evidence as we possess is to the effect that after surgical interference with the globe it secretes excessively. Mr. Wallis proposes to massage eyes soon after operation. We have long done so in Madras in those cases in which there seemed a doubt as to the establishment of filtration. It is a sound procedure and one which, if carefully conducted, is quite free from danger. The patient easily learns to do the massage himself.

To return to our original subject, I suggest that in the cases of late suppuration following trephining the route by which the micro-organisms entered the eye was along these tiny open channels in the edge of the flap. This seems more likely than the transconjunctival route. In any case, the danger of the occurrence of these fistulas is one which should ever be in the surgeon's mind when he finds the anterior chamber fails to fill as it should. I am tempted to wonder whether our immunity to these late infections is not in part at least to be attributed to our early care of these tiny external fistulous openings.

THE SITE TO BE SELECTED FOR A TREPHINING IN THE PRESENCE OF A GLAUCOMA IRIS COLOBOMA

I have been consulted by surgeons on this point and have seen the advice given that "the subsequent trephining must be made well away from the coloboma, for otherwise there is no protection

to the lens or zonule." This is contrary to my practice, and as my results in dealing with these cases have proved very satisfactory, you may be interested in my method of dealing with it. I always trephine, if possible, over the middle of the coloboma, and that for two reasons, namely, (1) the coloboma is usually directly upward and therefore in the usual quadrant of selection for trephining, (2) the absence of iris tissue from the neighborhood of the trephine hole greatly simplifies the operation and adds to the safety of the after-course of the case.

Two difficulties might be expected to confront one in dealing with such a case, namely, that of raising the flap beyond the scar of the keratome wound of the previous iridectomy, and that of reopening the keratome incision and having therefore to trephine on a comparatively unsupported and mobile structure. In the case of a lady whose eye I recently trephined in England, both these complications were met with, but were overcome without undue difficulty, thanks to patience and the use of a sharp trephine. The former complication (that connected with the adhesion of the old scar) is constantly met with in these cases. It sometimes makes the dissection of the flap a little more difficult, but I have never found that difficulty insuperable, nor have I ever wounded a lens or its capsule in the course of trephining one of these cases. In the course of my recent clinics in Minneapolis I had several opportunities of demonstrating to those who attended them that it is not only possible but usually even easy to split the cornea in old iridectomy cases right over the seat of the old keratome incisions.

THE QUESTION OF SUTURING THE FLAP AS A ROUTINE PROCEDURE IN TREPHINING

Some surgeons advise that the flap should be sutured on every occasion. So far as trephining in the upward quadrant goes, I do not agree with this. If the flap is found to show no tendency to keep in place, a suture should of course be used, otherwise it is better to omit the extra step. We thereby shorten the operation and get the patient back to bed quicker, which I look on as most desirable from every point of view. In addition, we avoid the risk of sepsis, which, though very small, is nevertheless inseparable from the use of sutures on an eye in which, owing to the conditions of fluid filtration, the interior of the globe is in constant touch with the sutures we have inserted. In my own cases I found the demand for a stitch during the after-course of a case occurred in less than 1 per cent. No harm has resulted from the use of this

stitch when thus called for, and the patients have not complained of any pain during the small procedure. It may be worth noting, however, that we *always* combine adrenalin with cocain in such cases. It has been urged that the band of scar tissue formed is less broad when a stitch is inserted. I do not deny that this may sometimes be the case, but it does not appear to me a very important matter. There is something to be said both for and against suturing our flaps, and each surgeon will decide the question for himself. I think, however, that a surgeon who makes very large flaps (as I always do) will find that he comparatively seldom needs to use a stitch. Such flaps lie out much smoother than do smaller ones. In downward flaps the advisability of using a suture is much less a question of dispute, while in lateral flaps one should never omit suturing the conjunctiva. In cases operated on under general anesthesia it is probably advisable to use a stitch, as the patient may be unmanageable and careless while "coming out" of the anesthetic. Moreover, a delay in such cases is not a serious disadvantage inasmuch as the patient does not tend to squeeze the eye; the one who is not anesthetized does.

BLOCKING OF THE TREPHINE HOLE BY CONNECTIVE TISSUE

I have never claimed that trephining is invariably a successful procedure. Such a claim would be absurd. From my first paper onward I have recorded my failures and have endeavored to find their causes. As at first pathologic material was not available, I was driven to make the best use I could of my clinical observations, and from these I learned that the trephine hole might become plugged with connective tissue derived either from the episcleral tissue or from that in the depth of the trephine hole. Among these latter, uveal tissue first plugging the wound and then undergoing proliferation seemed to occupy a prominent place. Recently Mr. Sydney Stephenson has cut some eyes which have been sent home from Madras after enucleation for failure of trephining and has confirmed anatomically my clinical deductions. His work will soon be published and is of great interest. Other cases of the same kind have been submitted to anatomic examination and presented at Oxford and elsewhere.

More recently, Dr. Ducamp of Paris has made a very interesting and valuable anatomic study of my technic on animals. All this work is to be most cordially welcomed. It has a very valuable place in the study of the technic of sclero-corneal trephining, but what I do deprecate is a tendency on the part of some observers

to deduce that these methods of failure are the usual course of a case after trephining. *They are nothing of the kind.* The usual course is for the trephine hole to remain patent and fistulous. This is proved by the experience of a large body of surgeons spread over the whole civilized globe. What these cases of failure do teach us, and the lesson is most valuable, is *how failure may and does occur.* That is their lesson — quite a big lesson, too — and nothing further should be read into them.

There is one last point on which I would dwell for a moment. It is hardly just to modify my technic and then to attribute the failures encountered to the original method, which has not been followed. It would not be very difficult to show that in some cases in which this has been done the failure was almost certainly attributable to the modification of the technic and not to the original technic at all. Again, it is very difficult to argue from experiments on animals and man. Take the case of sheep's eyes. It is almost impossible to split the cornea in these animals, and, indeed, it is very difficult even to dissect the conjunctiva up to the limbus. The same appears from Dr. Ducamp's experiment to be the case with cats. Such animals are therefore unsuitable for the technic I have advocated, and little stress can be laid on deductions from experiments on them.

CONCLUSIONS

A good deal has been written about spongy filtering cicatrices, and a wonder has been more than once expressed whether these eyes, in which one finds a cicatricial plug blocking the trephine hole, are still filtering. I do not know of any anatomic evidence of filtration apart from fistulization, nor in my opinion is it likely that such a thing occurs. It is much better, to my mind, to frankly own these cases as failures, rather than to evolve fanciful theories to mollify our natural disappointment. I believe that when an eye shows filtration after a sclerectomy or a sclerostomy (call it what you will) that filtration occurs through fistulous channels, and through these alone. It may be that, sometimes instead of their being one large fistulous track, there are several or even many small ones, but that is merely an unimportant modification. The existence of a "spongy, permanently filtering tissue" has never, so far as I am aware, been satisfactorily demonstrated, and the idea is, moreover, in contradiction of the known properties of fibrous tissue, which are to contract and become increasingly dense and be converted into hard, impermeable scar tissue. The existence of fistulous passages through the tunic of the eye is becoming

steadily established in the minds of surgeons all the world over, by the observation of their cases after operation. Anatomical records will follow in time as the subject of these filtering eyes pass into the hands of the pathologist. It is most important that we should lose no opportunity of acquiring and making the most of such material.

There is a view, widely held among ophthalmologists, that the entanglement of uveal or other intra-ocular tissue in the track of a wound is liable to lead to the formation of a filtering cicatrix at that spot. Any surgeon in large practice has seen many wounds in which encleisis of the iris has been a step in the healing of a wound which has ultimately proved to filter permanently. This fact is taken as supporting the cause-and-effect relationship of the two things. So imbued is Dr. Ducamp with this idea that he goes so far as to say that "it is extremely probable that the same phenomena," that is, cicatrization and closure of the trephine hole as found in cats, "are always produced in man, unless a heterogeneous element forms a mechanical obstacle to regular cicatrization, and to the repair of the loss of substance" (that is, in the sclerocornea). Now, apart from the fact that Dr. Ducamp did *not* follow my technic in any of his experiments, and that he could not do so owing to cats being unsuitable for it, I think these are good reasons for thinking his view incorrect. Those reasons at present are founded on clinical observations; but I have little doubt time and opportunity will supply the necessary anatomic confirmation.

I shall now set forward the clinical side of the question, and add to it what appears to me to be the logical deduction therefrom.

1. From our earliest trephinings we observed that the entanglement of uveal tissue in the wound constituted a grave menace to the permanency of filtration. This was a strong factor in driving us to place our trephine wound far forward away from the dangerous neighborhood of the iris base and of the ciliary body. It was not merely that the tissue blocked the hole mechanically, but that it appeared to lead to its obliteration by exciting connective-tissue proliferation. In any case wounds in which uveal tissue were entangled, so far from having a tendency to filter permanently, were always and justly a source of anxiety to us.

2. When we moved our trephine hole farther forward on the cornea, we found that iris complications vanished and our results improved. This was due to the fact that our trephine hole was farther away from the angle of the chamber, and that in consequence we did not have to deal with uveal tissues tethered to

the cornea quite close up to the point at which we had made our opening; and our trephine hole was on a place anterior to that of the iris, so that the moment the chamber filled the iris tended to fall back from the hole.

3. The size of the trephine hole renders any blocking of it most dangerous, as in view of the small sectional area there is, at the best of times, such a narrow margin for the security of the filtration being maintained.

The whole of the clinical evidence at our disposal negatives Dr. Ducamp's idea and indicates that an iris-free trephine hole is not merely what we should aim for, but what we have a right to expect.

Dr. Ducamp has in his very able monograph confirmed anatomically many of my clinical deductions. Mr. Sydney Stephenson and others have done the same, and I venture therefore to ask your indulgence when I claim, as I confidently do, that anatomical evidence will in time be forthcoming to show that the ideal successful trephining is that in which the fistula is free of all heterogeneous elements. I would go farther and, at the risk of being thought very heterodox, I should like to put a last problem before you, namely, what is the evidence that the inclusion of uveal or other tissue leads to the formation of a filtering scar? Is it not conceivable that those wounds which have a disposition (by virtue of their gaping or of some similar factor) to become filtering wounds are the very wounds in which intra-ocular tissues are apt to be included and caught? Is it not a fact that sometimes at least the inclusion of iris in a wound tends to make its edges seal down all the more firmly? Why, then, should we argue that it should tend to keep a wound open? Have we not been confusing cause and effect?

In conclusion I desire to acknowledge the universal and extraordinary kindness, courtesy and hospitality I have received at the hands of American ophthalmic surgeons since I arrived in this country. Your vice-president has spoken of the rosy hues in which he painted my visit to America, but the realization has far outshone any description he was kind enough to give me.

REPORT ON TWENTY CASES OF TREPHINING FOR GLAUCOMA

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Trephining as a treatment for glaucoma is still a new subject, and what we know about it has been received principally from a few men who have had a great experience with it. Some surgeons are a little timid about trying this operation and it might be worth something to them to note the experience of one who is but a beginner in trephining.

I have used the Schiotz tonometer for measuring the tension in all these cases. I have used the Sydney Stephenson trephine, diameter 2 mm., in most of them. At the Illinois Charitable Eye and Ear Infirmary, in Dr. H. W. Woodruff's service, where most of these operations were done, I have now and then used other trephines. The main thing is that they are clean and sharp. I had the pleasure of seeing Dr. Holth do Elliot's operation in January, 1912. I also saw him do his own operation with the punch forceps. This latter operation seems to be a little more difficult to perform; therefore I have confined myself to Elliot's operation.

It is unnecessary to go into details and mention each case separately because many of them are so much alike. I will therefore mention those especially that are of the most importance in enabling us to study the value of this operation and its effects, and refer to other cases only when they present anything out of the ordinary.

The second case that I trephined was a man, aged 34. For several months he had had all the symptoms, subjective and objective, of glaucoma of the right eye. He had at times suffered great pain. When he came into the hospital, vision was limited to shadows and tension was 43 mm. The previous treatment had been eserin and dionin, two iridectomies at different times, and later another iridectomy was attempted but was not successful. The eyeball remained hard, the pain and suffering continued. After trephining the tension was lowered to 24 mm. and the patient greatly relieved. In this case we saved the eyeball and avoided enucleation.

The fourth case was a man who came into the infirmary in October, 1912. The sight of his left eye had been lost some time before, but during the past two weeks he had suffered severe pain. The eye presented the picture of glaucoma, with a large immovable oval pupil, atrophied iris; fundus could not be seen; tension 71 mm.; pain severe. He was first treated with sodium citrate solution under the conjunctiva without relief. Eserin and dionin were used without effect. October 20 an iridectomy was attempted, but was not successful. A prolapse of the iris was left, which caused some trouble and was later excised. The patient was not relieved from pain and tension was about the same. November 10 the eye was trephined, with the result that the eye quieted down, the pain was relieved, and the tension was 20 mm. when he left the infirmary two weeks later.

Case 8 was admitted to the infirmary with his vision in left eye limited to shadows. According to this man's story, vision in this eye had been failing for two months, but four days before he came to the hospital the eye became very painful and red. All the ordinary symptoms of an acute glaucomatous attack were present. Fundus could not be seen on account of cloudy media; tension 71 mm. The citrate of soda treatment, also eserin and dionin, were used without any relief. Iridectomy was then performed, when the tension was reduced to 62 mm. His suffering continued. Eserin, pilocarpin, etc., were again used without effect. After trephining the tension went down to 14 mm. and the eye gradually assumed a nearly normal appearance. Everything went to show that he would keep his eye when he left the hospital.

Case 9 was a woman, aged 55, who became totally blind in both eyes five years ago, when iridectomy had been done without saving her vision. She had since that time suffered more or less constant pain in her left eye and left side of her head and had been unable to get any relief. Tension in left eye was 44 mm. In order to lower the tension and relieve her pain trephining was done. The tension went down to 12 mm. and the pain in head and eye disappeared. She went to Alabama to live and I have heard recently that she is comfortable.

Case 10 was an old lady with some cataract in both eyes in combination with glaucoma. Vision was lost in the left eye, in which the tension was 68 mm., but an iridectomy had been done on her right eye to save what sight was left. Trephining the left (blind) eye reduced the tension to 20 mm. and vision returned so that she could count fingers at 3 feet.

Case 14 was an old lady, aged 74, who had an iridectomy performed six years ago when her vision was good; but vision had gradually failed in both eyes since then so that vision in the right eye was only faint light perception; in the left, counting fingers at about 3 feet. Tension was 60 mm. in each eye. Trephining reduced tension to 20 mm., but she complained some weeks afterward of a sensation of a foreign body in the left eye. She seemed to feel and be annoyed by the swelling or edema around the trephine hole. I could not find anything else to account for this complaint. It has troubled her now for several months. She is, however, a very nervous patient.

Case 16 was a man, aged 74, with a leukoma covering the entire cornea of left eye. No perception of light. The iris could not be seen. His eye has looked like this for many years, he said, but of late he had commenced to suffer severe pain in the eye and head. Tension in this eye was 70 mm. He came to the infirmary to have his eye enucleated, but he permitted me to trephine to see if we could save the eyeball. The trephining was done as usual, but I did not succeed in getting a piece of iris as expected. He had considerable pain the first day, but the second and third days he was quite comfortable; tension was down to 24 mm.; on the fourth day the pain commenced again and he was determined to have the eye enucleated, which was done. In this case I used atropin to control the pain after the trephining, and also salicylates. Possibly if we had been more persistent we might have succeeded. We should have obtained some improvement with such a reduction in the tension. An iridectomy would probably have been better in a case like this.

In one case I had quite a hemorrhage into the anterior chamber, which was all absorbed the next day. This was also a blind eye with tension high, 55 mm., and I went through the sclera a little quicker than I expected. The first three days the patient felt fine and the eyes looked very well, but in taking out the stitch the patient made a violent motion with his head and a little damage was done to the flap. The patient had considerable pain for a few days, which yielded to atropin and salicylate of sodium. He left the hospital after a two weeks' stay and his left eye gradually cleared up; but I was sorry to see a few days ago that his tension was 42 mm., and there was no evidence of filtration.

Infection did not occur in any of these cases, but considerable redness and pain was present in some a few days after the operation. This pain and redness was usually relieved by a laxative,

atropin, and sometimes asperin. In none of these cases where vision was present before the operation was any vision lost after the operation, as far as I have been able to observe. Tension went down in a satisfactory way in all except two, one of which I have related as being probably caused by the damage done in taking out the stitch. In the other case, where the tension was not lowered, the trephine hole simply healed up and left no filtration. Perhaps another operation will have the desired result.

The superiority of trephining over iridectomy was plainly seen in the cases in which iridectomy had been done once or twice without effect before trephining. If trephining is better than iridectomy in the later stages of glaucoma, why should it not also be better in the beginning, when the blood-vessels and other tissues of the eye are in a healthier state?

The main danger in glaucoma is tension. Glaucoma is too high intra-ocular tension plus its causes and effects. This increased tension without treatment destroys vision in every case sooner or later. Iridectomy only saves about 50 per cent., perhaps less. Iridencleisis was a great improvement over iridectomy because it positively reduced tension in a greater number of cases. The greatest discoveries are the simplest. This trephining is the simplest of all the glaucoma operations; it is almost like opening a little abscess.

I notice Axenfeld and Isakowitz in the *Klinische Monatsblätter* report two cases of infection. But infection is not what we are going to worry so much about in the treatment of glaucoma. What is going to be ever the most important thing is the tension. Infection is surely of secondary importance, because increased tension destroys 100 per cent. of previously good eyes, but infection here may destroy only 1 per cent. of glaucomatous eyes.

I have enjoyed very much the book on glaucoma by Dr. Elliot, and what experiences I have had coincide with his. One soon learns the importance of trephining well forward into the cornea; also to make the conjunctival flap as large and thick as possible by going close to the sclera, and to take care not to injure the flap.

Dr. Ask of Sweden uses pilocarpin or eserin several hours before operating. I think this possibly may help to keep the iris away from the trephine hole and assist to get the iris back into its proper position.

AN INQUIRY REGARDING INCREASED TENSION OF THE EYEBALL

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It is not without a sense of embarrassment that I venture to bring before you a paper on any phase of glaucoma after the presentation of Colonel Elliot's admirable address, based on his enormous experience at Madras. My hesitation is the more pronounced for the reason that my remarks are based so largely on my personal observations and study in a comparatively limited field. The inquiries and suggestions of this paper were formulated during my vacation in July and August of the present year before the presentation in England of Colonel Elliot's results and conclusions. Since its presentation, however, I have had the opportunity to consult the work as published in the *Ophthalmoscope*, and am gratified to note that in his discussion of some of the etiologic factors his views are entirely in accord with those I have sought to present.

I must, however, before proceeding, make my apologies for confining these remarks so largely to personal experience and the inquiries awakened in my own mind by this experience. It is not necessary in this presence to even epitomize the views set forth in the vast literature on the subject.

From my earliest years of ophthalmic practice to the present time, like some hardy perennial, increased tension of the eyeball has thrust itself on my attention not only in text-books and medical journals, but in the daily routine of professional work. In the private consulting-room and public clinic; in isolated examples and groups of cases, glaucoma in some of its protean manifestations has never been absent and has always presented a sufficient cause for anxiety to both patient and surgeon.

It is significant not only of the importance and gravity of increased tension of the ball, but of the unsettled state of our knowledge that, notwithstanding this wide opportunity afforded for its study, journal literature has never, since the publication of von Graefe's notable paper on iridectomy in 1856, been more replete with discussion of its pathology, or the expression of varying views as to the nature of the disease, or with the promulgation

of newly invented procedures for its surgical treatment. To me increased tension of the eyeball still constitutes one of the most perplexing and discouraging chapters in ophthalmology. We must admit in a word that Priestley Smith's definition that "glaucoma is increased tension of the eyeball plus causes and effects" still defines and outlines our understanding of the disease.

Notwithstanding this discouraging state of our knowledge, there are rays of hope shed on the subject by a more correct understanding of the anatomy and histology of the eye and of the essential nature of certain systemic conditions associated with the increased tension of the ball than formerly obtained. If we pass rapidly in review before our minds the considerable group of ocular conditions which either culminate in increased tension or threaten to do so, we will be impressed by certain significant facts. For example, if we consider the atypical forms of glaucoma — (*a*) The buphthalmic eye of infancy and young childhood; (*b*) the cases of serous iritis; (*c*) chronic, recurrent iritis of the plastic type; in each we find increased tension, seriously impaired acuity of vision and when possible to determine it, a contracted field; and, in the laboratory cupped optic nerve, frequently the signs of an optic neuritis, choriocyclitis, iritis, atrophied ciliary muscle, dilated ciliary vessels, a degenerated vitreous body and an opaque lens.

Another atypical group is constituted by (*a*) perforated cornea from corneal ulcer, or, by perforating and infected wounds, leading to partial corneal staphyloma, empty anterior chamber, iridocyclitis, increased tension and loss of vision. In the laboratory cupped optic nerve, inflamed and swollen, turgid or atrophic ciliary muscle, dilated ciliary vessels, degenerated vitreous and opalescent or opaque lens.

Approaching the usually regarded typical forms, that is to say, the so-called primary glaucoma, our minds at once revert to their usual grouping. (*a*) Glaucoma simplex or the so-called non-inflammatory type, regarding the nature of which there has been so much discussion. (*b*) The subacute inflammatory type; beginning with transient impairment of vision, recurring attacks, increasing in severity and with briefer intervals between the exacerbations, the inflammatory features and pain meanwhile growing more pronounced, the anterior chamber shallow, the cornea steamy, the iris atrophic; the impairment of vision, the contraction of the field and increased tension; at first transient but becoming permanent. The anterior perforating vessels (long anterior

ciliaries) become permanently engorged; from the first the transient attacks are associated with impaired range of accommodation. If neglected, total blindness ensues and the disease passes into a stage of absolute glaucoma. In the laboratory is found a deeply cupped, atrophic optic nerve, atrophic ciliary muscle with evidence of preceding inflammation, dilated ciliary vessels, degenerated vitreous body, opaque lens; invariably both eyes in near sequence are involved. (*c*) The acute inflammatory type, more violent from the onset, the final result as set forth in the former group rapidly consummated and the same laboratory findings in more exaggerated form. (*d*) The so-called hemorrhagic glaucoma, constituting one of the most striking and hopeless forms of disease with which the ophthalmic surgeon meets.

GENERAL CONSIDERATION

We have in this summary eight well-defined groups, differing widely in their clinical history, but nevertheless drawn into one common group, characterized by increased tension of the ball and its disastrous sequelae and by certain pathological findings in the laboratory more or less common to them all.

What relation, if any, do they sustain each to the other?

Is there some etiologic factor, more or less common to them all, to which the increased tension is secondary?

In discussing these inquiries there are certain general considerations which cannot be evaded. If we take, for example, the buphthalmic child with its destructive uveal disease, beginning before birth or during infancy or early childhood, we find that it is obviously dependent on or constitutes a part of some general, usually hereditary disease. I have published a striking example of the latter under the caption of prenatal iritis in a syphilitic child, in which the buphthalmos occurred and the child passed into imbecility, the victim of syphilitic endarteritis.

In the secondary increase of tension in serous iritis and also in iritis of the plastic type, I have many times had the opportunity to witness the onset of the iritis while the patient was under treatment for uveal disease and the underlying systemic affections of which the ocular disease was but one of the local manifestations.

In practically all cases of idiopathic iritis, if seen sufficiently early, when an ophthalmoscopic examination of the fundus oculi is still possible, careful study will reveal a fluffy eye-ground, dark, homogeneous red in color, full vessels with all details veiled or obscured by infiltration or edema. As the disease advances to the

ciliary region and iris, the anterior part of the vitreous and the aqueous become cloudy with infiltrate and the ciliary vessels deeply engorged. The increase of tension in the globe does not always wait for the formation of annular synechia to exclude the anterior chamber, and the closure of the angle by iris bombé and corneal adhesions. The increased secretion (dialization) from the inflamed uvea of fluid, colloidal in character, and of higher specific gravity, has already overloaded the pectinate screen at the angle of the anterior chamber and the canal of Schlemm, and caused pathologic changes in the region of the *ora serrata* and the *vena vorticosa*, so that drainage is delayed or rendered impossible and tension of the ball increases. The excruciating pain is one of the evidences of this increase of tension.

What is the nature of the disease which has fallen with such disastrous consequences on the eye?

The day has long since passed when idiopathic iritis in any of its forms is regarded in any other light than as a local expression of a variety of systemic affections, e. g., syphilis and rheumatism, in some of their chronic forms; gout, tuberculosis and other infections and toxemias, either endogenous or exogenous in origin.

Neglecting for the present the so-called simple glaucoma, I pass to consider the inflammatory types.

Here, again, the ophthalmoscopic study is important. In my early experience I was so intent on the study of the optic nerve and retinal arteries for a possible cupping of the former and the presence of the arterial pulse that other things were doubtless overlooked, but not so of late years. The posterior pole of the fundus may be relatively normal in appearance while the periphery of the ophthalmoscopic field is fluffy and veiled; a fact which may account, as Fergus has pointed out in chorioidal affections, for certain limitations of the field of vision which, in examples of increased tension, we are prone to ascribe solely to the condition of the nerve as the result of pressure. Then, too, the failure of the accommodation in the early stage of the glaucomatous process points decidedly to disease in the ciliary region involving the contracting power of the ciliary muscle, and possible to some pathological interference with the suspensory ligament bathed, as it must be, in the products of inflammation. The early transient attacks are not infrequently associated with halos around the flame, even when there is no demonstrable steaminess of the cornea. I have frequently been able, with + 12 D. and a strong light, to detect with the ophthalmoscope a fine granular infiltrate back of

the lens, apparently occupying the space between the lens and the anterior border layer of the vitreous body, whither it had probably proceeded from the inflamed ciliary region through the complex fibrillated structure constituting the so-called suspensory ligament of the lens.

But what is the etiologic factor behind the ciliary inflammation? The primary glaucomas, so-called, have long been recognized as a disease prone to attack individuals who are approaching or have passed beyond the meridian of life. The occurrence of primary glaucoma prior to this period is certainly relatively rare. It is therefore a disease coming on at an age when the wear and tear, the harrassing vicissitudes, the misfortunes, the exposures, overwork and vicious living have sapped the physiologic foundations of life; when infections have found entrance to the structure of the organism through the doorway of the epithelium, and when a variety of toxic or auto-intoxications and other influences have set up vascular and cardiovascular disease and the associated nephritis, uveitis, high blood-pressure, etc. Primary glaucoma, in fact, rarely occurs in individuals in good general health. In advanced age and in advanced stages of general vascular disease or in the presence of some general dyscrasia, in what organ of the body, reasoning *a priori*, would we be more likely to find local expression than in the tissues of the highly vascular uveal tract of the eye, e. g., general uveitis, retinal hemorrhages, hemorrhagic glaucoma? Have we analogies? Do we find, by way of illustration, analogous conditions elsewhere in the body? Do other organs than the eye suffer disaster because of the changed constitution of their nutritive fluids? Do other organs, e. g., the brain, the kidneys, the serous cavities or the mucus-lined sinuses in the anterior segment of the skull or the ductless glands execute their functions normally and remain in perfect health in the presence of blood-streams and lymph-streams loaded with the toxic products of an impaired or faulty metabolism? Clinical experience compels a negative answer. How, then, can we expect that the highly vascular ectodermic and mesodermic uvea should escape the disasters which befall the other organs of the body in the presence of impaired metabolism, hereditary disease, acquired infections and toxemias? In certain toxic conditions, characterized by an acidosis of the tissues, the mucous membranes become engorged and edematous. If those lining the turbinals in the attic of the nostrils are involved together with the membranes lining the accessory sinuses we have impaired drainage, stuffed cavities, increased pressure and pain.

In chronic rheumatic or gouty subjects, the swollen and painful joints following exposure, indiscretions in diet, giving rise to toxic or other states of the blood, affords an analogous condition of pressure and pain. Uremic coma affords a striking example of intracranial edema and pressure.

In the eyeball, while the pathologic states are probably more or less closely analogous to those affecting other organs, the complex and extremely delicate anatomical mechanism by which its functions are performed introduce other factors. The drainage system of the eye, although sufficient in health, may not be adequate if the fluids to be drained into the lymph-spaces surrounding the eye are changed in their quality by disease of the tissues which secrete them, or the filtering tissues themselves may suffer injury and their functions become impaired by contact with tissue juices or at least changed in character. By way of illustration of what may occur as the sequelae of inflammation of the chorioid and ciliary region, recall the infiltration into the vitreous body in cyclitis rendering it cloudy. The infiltrate may often be resolved by a convex glass behind the ophthalmoscopic mirror into a fine granular web apparently near the posterior capsule of the lens. Why has this filtrate not been carried forward into the anterior chamber? Is it because the filtrate, in consequence of its changed character, can no longer pass through the fine fibrillar structure we know as the suspensory ligament and zone of Zinn? Or has this structure itself been injured by the inflamed ciliary muscle and contiguous tissues from which it springs? In either case, may we not find here a sufficient explanation for the accumulation of fluids back of the zonule, for the pressing forward of the lens, resulting in a shallow anterior chamber, a partial or complete closing of its angle by the periphery of the iris, which, because of its participation in the uveal inflammation, becomes firmly glued to the cornea at the angle or dragged backward by the atrophic and contracting ciliary body and ciliary muscle?

In such reasoning we may find a possible or even a probable picture of the pathological history and also an explanation for the clinical course pursued by not only the atypical forms of increased tension of the globe, but also for the clinical picture of inflammatory glaucoma.

But, you ask, why do not all cases of uveal disease result in pathological tension of the ball? I can only answer I do not know. But we do know that hypermetropic eyes are more prone to suffer increased tension than myopic; that eyes with a thick, rigid

sclera, presumably more unyielding, are also prone to glaucoma. In this connection I call attention to a well-known clinical fact: the increased refraction in eyes after a severe attack of irido-chorioiditis. I have many times seen a hypermetropia diminish or an actual myopia develop without swelling or demonstrable displacement of the lens; therefore, presumably due to an axial change in the ball. The thin or yielding sclera has distended under intra-ocular tension. Had the sclera been less yielding under intra-ocular pressure, it is conceivable that glaucoma would have resulted instead of distention of the globe. In this reasoning we may find another explanation for the rarity of glaucoma as well as the tendency to myopia in early life.

Again, you ask, how are we to explain glaucoma simplex, that is, the so-called non-inflammatory glaucoma?

In reply, I turn for study to a large clinical experience. I have under my care at the present time three fairly illustrative examples. One of these patients, a large, sturdy man, aged 58, who had for many months been under the advice of different ophthalmic surgeons, each of whom had advised the persistent instillation of eserin or pilocarpin. At no time, if his statement can be accepted as true, had there been pain or redness of the eyes. When referred to my clinic at the Wills Hospital, the right eye was totally blind, the ball hard, the iris discolored and atrophic, pupil dilated, the anterior chamber shallow, the long anterior ciliary vessels engorged and the cornea steamy. The nerve was cupped, but was indistinctly seen through the cloudy media with the strong light of the electric ophthalmoscope. The eye had passed from a glaucoma simplex or from a non-inflammatory type to an inflammatory glaucoma. I have had very many opportunities to witness this clinical picture.

The fellow eye had V. = ⅓, tension + 1, a contracted field, a shallow but typically cupping nerve, surrounded by a yellowish halo. The fundus details were veiled somewhat, but the media were clear. The pupil was not dilated, but reacted sluggishly to light and the iris was not discolored. It was a fair example of glaucoma simplex.

He was admitted to the house and placed in bed. The urine was acid, had a high specific gravity, hyaline casts, a trace of albumin and many oxalate crystals. His blood-pressure was 168 in systole. The tension of the right eye was 90, the left 44. He was placed on a diet of stale bread and skimmed milk, magnesia sulphate purge on alternate days, and an electric sweat-bath daily.

Internally he received 5 grains of calcium chlorid every four hours and 1/100 gr. of nitroglycerin three times daily. Under this regimen the blood-pressure fell to 150 and an iridectomy was done on the blind eye. The convalescence was rapid. The tension of the operated eye fell to normal and became white, but recovered no vision. The vision in the left eye rose to 6/v. T. = n./20 and the veiled fundus cleared. The man was discharged without operation on the left, to be observed as an outpatient.

The other two now under observation are private patients. Mrs. A., aged 57, claimed that she was in good health and had never had any serious illness. She came for advice on Aug. 4, 1913, and gave the following history:

She first sought advice for failing vision in the right eye in December, 1911. The surgeon found a deeply cupped nerve. She received mioties and used them continuously until August, 1913. The vision grew steadily worse until even perception of light was lost, but at no time had there been redness or pain. During the late winter of the present year the left eye began to fail as the right had done, notwithstanding the fact that she had steadily used the prescribed miotic. I found the following conditions present:

Right eye: No perception of light, T. = + 1, ciliary injection, long anterior ciliary vessels engorged, anterior chamber shallow, pupil contracted under eserin, lens nucleus strongly reflecting, no view of fundus, right peri-orbital pain variable in severity.

Left eye: White, long anterior ciliary vessels full, T. = n., anterior chamber normal depth, iris apparently healthy, pupil contracted under eserin, no pain, V. = 6/vi, but fails before line of letters is completed. Field of vision shows a nearly concentric contraction to 20 degrees. She was admitted to a private hospital for general study and the eserin omitted.

The urine had a specific gravity of 1.028, with a trace of albumin and a few hyaline casts, no sugar, but a trace of indican. Blood-pressure was 195 mm. in systole; no serious heart lesion. She was placed in bed on stale bread and skimmed-milk diet, sulphate of magnesium purge on alternate days, gr. v of calcium chlorid every four hours and 1/100 gr. of nitroglycerin three times daily and electric sweat-bath daily. By August 8 the specific gravity of the urine had fallen to 1.017, the blood-pressure to 170 mm. in systole and I did a cautious peripheral iridectomy on the right eye under ether anesthesia. The operation was smooth and was not followed by any reaction, but the anterior chamber

remained empty until the 11th, three days after the operation. The ball was soft, free from tenderness or pain and the general blood-pressure had fallen to 156 mm. On the 14th the anterior chamber was formed, T. = n., eye nearly white. During these days the left eye showed a doubtfully increased tension, the eserin being omitted.

The ophthalmoscope showed transparent media, a typical glaucomatous cup but details of fundus veiled. The eye was white and externally apparently healthy. Ether was administered and a peripheral iridectomy made on left eye. The operation and convalescence were uneventful. On the 17th, eye white, anterior chamber restored, wound smooth, blood-pressure 140 mm. She was allowed to return to her home on the 22d. V. = (with correcting glass) 6/vii i/2, T. = n. and field of vision for form approximately normal. The general régimen and treatment have been continued.

This also was an undoubted case of glaucoma simplex which in the right eye had passed into subacute inflammatory glaucoma after blindness had resulted and was associated with a general toxemia, probably intestinal.

The following history is one of signal interest:

The patient is a personal friend. Her mother, aged 84, had been under my care for recurrent iritis resulting in secondary glaucoma, but without annular synechia although there were several slender attachments of the iris to the lens capsule. The daughter, aged 40, in 1896 consulted me for asthenopia and received correcting glasses for hypermetropic astigmatism, which gave normal acuity of vision in each eye. She was the mother of two healthy daughters, both of whom had high errors of refraction. One daughter passed, while under observation, from hypermetropic astigmatism into mixed astigmatism and finally into myopia through the turnstile of astigmatism, that is, from distention of the sclera. Mrs. X. wore her glasses comfortably, receiving changes to meet her increasing presbyopia until 1904, eight years. She then presented some condition which is not noted, probably the rapid increase in presbyopia, but led me to place in the record "advised to keep the eyes under close observation." Notwithstanding this advice she did not come again, until 1907, although her children were more or less constantly at the office. She had had no pain, the eyes had not been red or troublesome in any way, but the occasion of her visit was the accidental discovery that she saw badly with her left eye. V. = 6/v in the right, but in the left only the largest letters on the chart and these only by eccentric fixation. There was only an island of retained vision in the temporal field and a deep, typical glaucomatous cupping of the nerve, which was gray-green to the scleral

ring. T. = + 1. In the right the field was normal, but a commencing cup in the lower part of the nerve. T. = n.

The anterior ciliary vessels in the left were large, but not so in the right eye. The media were transparent. No note is made regarding the general fundus conditions.

In the meantime she had developed a lithemic diathesis and nodules had formed on the finger joints and she suffered pain after errors in diet, overexertion or changes in weather, especially from a sudden fall in temperature.

A broad iridectomy was made on the left eye, resulting in normal tension, a considerable improvement in the field and V. = 3/60 with slightly eccentric fixation. She was much alarmed lest the right eye should pursue a similar history and before many weeks complained of transient spells of dim vision following fatigue or imprudence in diet. When her arthritis was more than usually painful the ball became tender to palpation and would not bear work. At such times, the field showed transient impairment and she had occasional pulsation in the lower central artery of the retina. I then did an iridectomy on the right eye on April 16, 1907. After an uneventful and complete convalescence, vision with her correcting glass rose to 6/v, tension and field remained normal in the right and unchanged in the left until Jan. 2, 1913. She then began to suffer marked increase in her arthritis, her hands presenting a most painful illustration of its deforming influence, some of the articulations of the fingers and thumbs being dislocated. In addition, domestic sorrow came and in its train rainbow vision, impaired fields, increased tension in both eyes but higher in the left, peri-orbital pain and great suffering from the *arthritis deformans*. In a word, a complete recurrence of glaucoma in two eyes with typical iridectomies in each and which had remained entirely well and free from tension from April, 1907, to Jan. 2, 1913, six years, with V. = 6/v in the right eye and no change in the left. The bulbar conjunctiva, which, following the iridectomy on each eye had always exhibited the evidence of free drainage, now became snugly adherent to the sclera. The left eye now lost all useful vision, but the right, under the use of eserin, high-frequency current and general treatment, maintained V. = 6/v, but at times showed tendency to fail and the field contracted.

The sclera in both eyes became more rigid, the anterior ciliaries more engorged and the fundus details veiled by an increasing edema of the retina and chorioid. At the same time, the nostrils and accessory sinuses became stuffed by a boggy or edematous mucous membrane. Vision fell to 6/xxx in O. D. and the blood-pressure rose to 185 mm. The corneae were clear, but she was greatly troubled by rainbows about the lamp or gas flame. She was then admitted to the hospital, placed on a diet of skimmed milk and stale bread, sulphate of magnesia purge, nitroglycerin and electric sweat-baths, under which the blood-pressure fell to 160 mm. A large anterior sclerotomy was then made on the right eye with a cataract knife under general anesthesia. The section

made in the same manner as in compound extraction, but further back, opening the old scar of the former iridectomy. Bleeding was very free but convalescence was rapid. The tension fell to normal and two weeks later she returned to her home with V. = 6/ix and marked increase in the field of vision and freedom from pain. In less than a week vision again fell to 6/xx with + tension.

She was then admitted to the private hospital separated from certain annoyances inseparable from her home life, where rest and quiet could be enforced and the diet and general treatment supervised. Under the régimen adopted and electric-light sweats the blood-pressure came down to 140 mm., her general health improved, she slept well, ocular tension came again to normal in the right eye and was much reduced by eserin in the left. She then went to the seashore with V. = 6/vi in the right, which has been maintained.

The history of this case has been related at some length for the reason that it is replete with suggestion as to the etiology of glaucoma and its relation to systemic disease, even in its apparently non-inflammatory type, that is, in glaucoma simplex, of which at the outset it was an unquestioned example.

In the first place the eyes were under observation for eight years because of an error of refraction without furnishing the remotest suggestion of a glaucomatous process other than the too rapid development of her presbyopia. During these years, from 40 to 48, she became the victim of an advancing rheumatic or gouty diathesis with *arthritis deformans,* and with this general dyscrasia came ocular disturbance, consequent on delayed drainage, impaired range of accommodation, rainbow circles about the gas flame; a hazy edematous retina, increased tension of the ball — iridectomy.

Following the performance of iridectomy she sedulously followed a regulated diet, took alkalies and the salicylates and maintained vision of 6/v for six years without change in the fields. Then came a chapter of domestic affliction and with it a rapid increase in her arthritis and *parri passu,* rainbow vision, increased tension, a closure of the filtration at the site of the iridectomy, contracting fields and lowered sharpness of vision, a vitreous filtrate and edema of the fundus, the recurrence of the process being apparently due to changes in the tissue of the globe, especially in the region of the *ora serrata,* similar to or identical with these which had occurred in the joints, closing the filtration channels in the anterior segment of the globe.

Before closing, I wish to call attention once more to the laboratory findings in eyes enucleated after periods of increased tension — the atrophy of the uvea in the ciliary region and the dilatation of the blood-vessels. It is obvious that the shrinking of the ciliary muscle, ciliary body and processes would cause a contraction of these tissues and a drag backward of the root of the iris and the meshwork composing the pectinate screen at the angle of the anterior chamber, together with the blood-vessels of the ciliary zone of the iris. It is the cutting free of these contracting bands, severing the blood-vessels between the most anterior border of the ciliary body and the root of the iris through a considerable sector of the circle of the iris root, which in my judgment results in the benefit afforded by a properly performed iridectomy. No other procedure with which I am familiar severs these pathological adhesions to the same extent as does a successful peripheral iridectomy.

CONCLUSION

If the suggestions of this paper are fortunately to be accepted as true, then glaucoma takes on a different if not a new meaning and must be regarded as a convenient appellation for the ocular manifestation or expression; on the one hand of a general or endogenous infection or toxemia, on the other an exogenous or local infection. That treatment must be addressed to the etiologic factors, which if recognized early, holds out the hope of prevention; that, failing in this, operation is designed to ward off temporarily the sequela of increased intra-ocular tension.

THE USE OF PILOCARPIN AND ESERIN IN DISEASES OF THE EYE

ROBERT SCOTT LAMB, M.D.
WASHINGTON

In calling attention to what I believe to be a new use of pilocarpin and eserin, I wish it understood that some six years have been spent in trying out the drugs on clinical, hospital and office patients, and if any one has preceded me in this field of experiment I have so far not discovered it.

Whereas it all started from a desire to know if the use of pilocarpin and eserin in glaucoma was not attended with something besides myosis, such as contraction of the capillaries or some analgesic effect (there was a time when hypodermic injections of pilocarpin were given for neuralgia), yet the consideration led me to the hypothesis that either drug could be used to give tone to the circulation in and about the eye, in some such manner as would be done by revulsion in hydrotherapy.

I began using pilocarpin in the strength of 1 grain to the ounce, 1 drop t.i.d. in such eyes as it seemed to me would be benefited by this tonic or stimulating action of the drugs. It was used in cases of herpes, chronic iridocyclitis, retinitis, neuroretinitis, chorioretinitis, angiosclerosis, and others which will doubtless come to your minds; also in some rare conditions, as true zonular keratitis and neuroparalytic ulcers; also in the marginal ulcers in elderly persons. In a word, then, the drugs were used in nutritional disturbances of the eye.

As to the eserin, I may say that with few exceptions I did not prescribe it for use at home (because of the irritation and the danger in its use); however, I did and do use it in the office.

Though I have mentioned these drugs in connection with diseases of the eyes, please do not for one moment think other local measures—as dionin, in powder or solution, hot applications, mercury friction to the temple, etc.—were neglected. Neither would I have you think any disorders of the general system were left untreated. The pilocarpin and eserin are given first mention because the results in my work to-day, due to their use, are so much better than those obtained prior to their use.

There is one condition I consider separately because of a paper which we heard read last year—on migraine or unilateral headache, or hemicrania with scintillating scotoma.

Occasionally, when migraine was under discussion, I have heard it said "that homatropin did not improve the condition, but made it worse; therefore it was not due to eye-strain." I never yet have heard one say "therefore I used eserin," but I take this opportunity to say it to you. For, in my refraction I have found many cases of migraine, some using prisms, some where muscles had received marked attention and patients had "been the rounds," so to speak; correct lenses had not relieved, and the ache, which is very typical, had not disappeared.

Without exception, so far as I can learn, the typical cases of this condition have recovered. Several of the worst (those who have previously found it necessary to go to bed three or four days every month because of the hemicrania and attendant vertigo and vomiting) still have slight aches, about once a month or six weeks, which respond to one or two treatments with eserin and dionin powder.

Of course, after several years' work along some line, one gets enthusiastic; but I will not regale you with a long series of cases. One condition may, however, with propriety, be called to your attention. In patients whose eyes anatomically or because of gout, etc., are predisposed to glaucoma, and where there is a family history of glaucoma, this treatment that I have suggested to you has been effective in relieving the symptoms of the prodromal or remission period, and so far none in the remission stage has come to an acute attack.

All I care to say in conclusion is, try it before condemning, for personally I am much pleased with the results and I therefore bring it to you for your consideration.

THE ELLIOT TREPHINING OPERATION FOR GLAUCOMA

REPORT OF TWENTY-SIX CASES

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I think it may be safely stated that about fifteen years ago the glaucoma question seemed to have resolved itself into the dictum that inflammatory forms of glaucoma were to be attacked by iridectomy, while chronic non-inflammatory glaucoma lent itself more to drug than to operative treatment. By this is meant that acute and subacute or congestive glaucoma not promptly amenable to drug treatment became frankly an operative condition, while on the other hand chronic simple non-inflammatory glaucoma so often failed of arrest or improvement under iridectomy that the profession felt itself driven to miotics locally, combined with eliminative drugs and methods internally. The last resort in such cases was naturally iridectomy again, which conferred but a temporary respite from blindness, as shown by Posey and Zentmayer.

Pessimistic as it may seem, the profession had pretty well settled down to this attitude in the matter when the advent of the ocular tonometer and the advocacy of the new filtration operations roused interest in the question anew. That this interest has by no means abated but has steadily increased is strongly evidenced by the voluminous literature devoted to glaucoma. Three phases of the subject have dominated the field, namely, tonometers and tonometry, study of normal and abnormal filtration, and the description of all manner of new filtration operations.

The year 1911 brought forth a literature of 150 titles, while 1912 surpassed it with 160 titles and 1913 thus far with its 144 titles for nine months bids fair to quite overtop its predecessor. The largest and clearest consideration of the whole matter is set forth in Colonel Elliot's recent volume on sclerocorneal trephining (or sclerostomy, as he now prefers to call it, and properly so.) It is a masterly presentation of the whole operative phase of the glaucoma question, judicial in tone and worthy of the closest study by every thoughtful ophthalmic surgeon.

In this communication, as the title indicates, no reference will be made as to the theories of the origin of glaucoma, nor of its

diagnosis, the operative treatment of the condition being our concern.

Assuming that the surgeon has decided in a given case of glaucoma that operation is indicated, his choice lies between the classic iridectomy of von Graefe on the one hand, or one of the filtration operations on the other.

THE CASE FOR IRIDECTOMY

Those who hold to iridectomy pure and simple as a complete and sufficient means for the control of the glaucoma process claim for it:

1. Ease of execution.
2. Short duration of the operation.
3. Prompt closure of the wound leading to
4. Lessened liability to infection.
5. Freedom from complications in the healing (no formation of synechiae).
6. Permanency of result.

These points will be considered seriatim.

1. That iridectomy in the presence of glaucoma is easy of execution even by the skilled operator is not freely conceded by all surgeons. The psychic state of the patient is of itself no small bar to a successful issue. The elevated general blood-pressure that goes with this psychic state naturally begets an intensified intra-ocular pressure with greater forward displacement of the iris and lens. More than usual shallowing of the anterior chamber results in increased difficulties attending the corneal section. Dextrous users of the keratome hold that a depth of 1½ mm. in the anterior chamber is sufficient to permit perfect introduction of the keratome. In a perfectly quiet patient this contention will hold, but every surgeon will admit that the average glaucoma patient is an unruly one, and that a finely placed corneal section, either with the keratome or a very narrow Graefe knife, is the exception rather than the rule. Granting, however, for the sake of argument, that an ideal corneal section has been secured, the sudden gush of aqueous at this point is fraught with great danger, for if the lens and iris are released and come forward too suddenly, dislocation of lens is more than likely and gross intra-ocular hemorrhage highly favored. Assuming, for further argument, that neither of these difficulties has arisen, the negotiation of the iridectomy in such cases is more painful than in other iridectomies (such as in cataract or optical iridectomy). Orbicular and extra-

ocular spasm at this juncture is pregnant with all manner of dire possibilities, such as presentation of the lens in the wound, vitreous protrusion, or destructive intra-ocular hemorrhage.

To push the argument further, all these steps may have been successfully and easily accomplished, completing the operation, when a ruptured choroidal or ciliary vessel will invalidate the whole procedure. A case in point I well remember occurring in my early practice. A woman of 55, in fairly good health, had gradually lost all sight with a progressive glaucoma of the low relapsing type. Complete secondary cataract had developed in both eyes. The candle fields showed marked limitation. There had been steady advance in the process, notwithstanding the most painstaking drug treatment for years. The tension was + 2. After consultation with a confrère, it was decided to operate on both eyes at the one sitting. The anterior chambers were of fair depth and a good-sized iridectomy was easily done on both sides. Immediately after excision of the iris in the first eye the lens presented in the wound necessitated its delivery. This also was comparatively easy and the eye was promptly closed and a bandage applied. In the second eye also the lens presented immediately following the excision of the iris and again the lens was easily delivered. Just at this point a tell-tale crimson blotch about ½ inch in diameter appeared on the surface of the bandage of the eye first operated, directly over the site of the wound. Nevertheless, the left eye was promptly closed and a snug bandage applied, but in about ten minutes this bandage also became completely blood-stained. The direst complication we are called on to face had occured in both eyes, namely, expulsive choroidal hemorrhage.

In the light of my present-day experience I am of the conviction that a correctly performed sclerostomy (or trephining) would have averted the calamity and given the woman a better chance with a cataract extraction later. Some would hold that preliminary sclerotomy would have been of great value in this case and no doubt it would, but wisdom after an operation does not avail the patient much.

2. Short duration of the operation.

It must be conceded that iridectomy is a much shorter operation than trephining or sclerostomy, but in our judgment this is more than overbalanced by the greater operative dangers attending iridectomy.

3. Prompt closure of the wound.

After the usual iridectomy, the wound will close in from twelve to twenty-four hours, while after Elliot's operation several days frequently elapse before the conjunctival flap has completely sealed itself, so that the weight of argument would seem to be with iridectomy. And yet, in nearly 900 cases Elliot has not had a single suppuration of the globe or serious iridocyclitis attributable to the operation, which would go to show that when the conjunctiva is properly dealt with it affords complete protection to the important structures it covers. This also meets Claim No. 4 of the advocates of iridectomy, namely, the lessened liability of infection after that procedure.

Mention should be here made of a few scattering cases recently reported in the literature of late infections occurring after trephining (from two to eight weeks after operation), but careful study of these reports seems to indicate that the conjunctiva was not properly dealt with as to size of flap, and that therefore late infection was favored.

5. Freedom from complications in the healing.

This aspect of the case has been recently so ably handled by Colonel Elliot in the *Ophthalmoscope* for October, 1913, that I cannot refrain from quoting his observations. He says:

"I have been asked why a 'quiet iritis' is so much more often met with after trephining than it was after the old iridectomy. I would first reply by another question, Is it really the case that it is more frequent? It is far from an infrequent experience to see the iris tied down after an iridectomy for glaucoma . . . I suggest that surgeons should carefully watch their cases for the occurrence of the so-called 'quiet iritis' with a view to establishing its relative frequency under the old and under the new operations. . . . It is an old adage that we see only what we look for, and I think that most surgeons will agree with me that many deductions from statistics would require profound modification were the notes taken daily on a schedule which reminded the overworked observer of the possible, and still more of the probable, complications for which he has to look out."

This quotation from one who has performed nearly 900 sclerostomies (trephinings) and whose reputation as a keen clinical observer has become world-wide, brings to my mind the contention I have recently made that about 40 per cent. of all cataract eyes that are operated on will show a slow, insidious iritis — what Elliot so aptly terms a "quiet iritis." It is by no means a frank condition, and as he trenchantly insists, is only seen *"when*

looked for." As to how much it affects the final result in iridectomies or cataract extractions is just now beside the question. The outstanding fact is that it frequently occurs after all operations on the anterior ocular segment, probably by altering the properties of the aqueous humor, and also delaying the healing.

6. Permanency of result.

Those who cling to von Graefe's iridectomy as the ideal treatment point very justifiably to the hundreds of cases in which patients who have been operated on many years previously still retain and enjoy all the beneficial results of the operation. Only recently there came under my observation a woman aged 55 on whom the late Dr. Harlan did a most beautiful double iridectomy twenty-five years ago. The coloboma was of about 6 mm. width in both eyes and extended well back into the angle of the anterior chamber. If every iridectomy for glaucoma were equally as beautiful as some I have seen after operation by Dr. Risley, and productive of results, the modern filtration operations would never have been devised. We have seen too many exceptions to this rule to accept any such postulate. The partisans of iridectomy, too, are fond of arguing that very few if any reports of trephining are more than 5 years old and they question what will be the state of these trephined eyes five or ten years hence. It would seem a reasonable rejoinder that seeing that such eyes are in good condition as to filtration and function from two to five years after trephining, the assumption is justifiable that they will continue to filter and function quite as well five to ten years hence, provided, of course, that their possessors remain in ordinary good health. At all events, comparisons as to permanency of result must remain unsettled for at least from five to ten years longer.

The case against iridectomy may be summed up in the following complications at the time of operation, any of which will at times be encountered by the best of surgeons.

1. Transfixation or engagement of the iris. This will happen at times in cases of shallow anterior chamber in spite of every precaution.

2. Wide-spread separation of the root of the iris, a not unusual incident with an unruly patient.

3. Partial or complete dislocation of the lens. It is held in some quarters that this complication is due to a bungling operation. While I am far from saying that this unwelcome presentation will not almost surely occur with a bungler, I also maintain that a sudden gush of aqueous may easily allow the forward dis-

placed vitreous to dislodge the lens from its attachments and drive it between the lips of the wound. Three times this accident has occurred to me and each time after as smooth an iridectomy as any operator could wish for.

4. Intra-ocular hemorrhage at the time of operation or almost immediately following it, is one of the gravest complications that attend iridectomy. Indeed, it is our feeling that any operator who makes an 8 to 10 mm. opening in the cornea not only suddenly releases the pressure on the intra-ocular blood-vessels at the time of incision, but leaves these weakened blood-vessls without any particular support until the corneal wound closes (from twenty-four to forty-eight hours). This objection obtains as much with the La Grange as with the von Graefe method.

5. Unruly patient.

When we consider the panicky state of many glaucomics and the erratic behavior of their blood-pressure, it will readily be seen that all manner of consequences may ensue. If one elects to operate under local anesthesia the patient may do irreparable damage by struggling and moving the head at an inopportune moment. Most surgeons aim to avoid these difficulties and the pain incident to the gush of the aqueous by resorting to general anesthesia, but even this does not absolutely ensure. I recall a patient who was supposedly under the influence of a general anesthetic and yet rose to an almost upright position on the operating-table just as I was about to complete the corneal section. This was quickly done in spite of the fact that the iris was driven before the knife, but almost immediately the lens presented in the wound and was followed by the vitreous. On the other hand the danger of vomiting after general anesthesia is too likely and grave an eventuality to be lightly regarded. If an operation could be devised that would "be easy of performance, devoid of serious risks and at the same time offer reasonable prospects of improvement or cure in acute or chronic glaucoma," it would soon be acclaimed as the ideal operation. Whether one of the modern filtration operations or some other one yet to be devised will fill this requirement, time only can show.

This much at least can be claimed for Elliot's sclerocorneal trephining: That it is relatively easy of performance, less risky than von Graefe's or La Grange's method, and reasonably promising of improvement or cure in both acute and chronic glaucoma.

At the Oxford Ophthalmological Congress two years ago, Colonel Elliot gave many demonstrations of his operation on

animals' eyes and it was my privilege to do a number under his direction.

Soon after my arrival home, a suitable case presented itself in my service at the Polyclinic Hospital. The patient, a man of 65, presented chronic congestive glaucoma in the right eye and non-inflammatory glaucoma in the left eye. The tension in the right eye was + 4; it was a sightless globe; the patient submitting to operation for relief of pain only. The anterior chamber was practically abolished, the pupil 5½ mm. in diameter and the lens so hazy that no fundus view could be obtained. There was marked fullness of the deep ciliary vessels and great ocular tenderness. Under local anesthesia combined with morphia and scopolamin internally, I did an Elliot's trephining and gained entrance to the upper angle of the anterior chamber without any difficulty. The eye immediately became painless, quieted down and healed rapidly. I was rather struck, however, with the prolonged localized reaction just above the cornea. It occupied a triangle about 5 mm. in dimension. In subsequent cases I learned that this is not unusual and need occasion no alarm. Two months later the tension was normal and the eye absolutely quiet and painless. The only evidence of the operation was the slight elevation of the conjunctiva at the site of the sclerotomy which (as Colonel Elliot has pointed out) I found would pit very readily on slight pressure with a probe.

Attention is directed to the fact that no difficulty was experienced in performing the operation under local anesthesia, nor did the patient have any special discomfort during the healing process. Since then I have trephined twenty-five other eyes, all of them under local anesthesia, some with and some without morphin-scopolamin aid.

Case No. 2 occurred in a 55-year-old Pennsylvania German, whose right eye had developed acute inflammatory glaucoma some five years before I saw him. For this state of affairs in his right eye he had had an iridectomy performed at the height of the inflammation (so he stated), but evidently the surgical intervention had come too late, as there was no gain in vision after the operation. At the time he was admitted to my service at the Samaritan Hospital his vision in the right (previously operated) eye was a poor 2/60 eccentric. There was no central vision at all. He stated that four days before admission his left eye, which had always been good, began to grow painful, with clouding of the vision. Vision on entrance equaled 6/60. The cornea was

hazy, the pupil 5x5½ mm., irregularly horizontal, and anterior chamber very shallow. No fundus view was obtainable. The tension was 25 mm., there was great ciliary tenderness and photophobia with high grade ciliary congestion. The patient was promptly mercurialized, miotics were ordered and he was sweated under pilocarpin. In spite of these measures his vision fell to 2/60. At this point he submitted to a trephining, done under local anesthesia, combined with morphin and scopolamin. Relief of all the symptoms was prompt and in two weeks his vision rose to 6/15, the tension fell to 18 and the ophthalmoscope revealed a cup of about 1½ mm. depth.

If I have dwelt on these two cases in detail it is because they both were of the inflammatory variety in which iridectomy has been looked on as the sheet anchor of treatment. In both of them sclerocorneal trephining proved itself curative. In Case 2 the parallel is even more striking, as iridectomy had failed of its purpose in the right eye.

Case 3 was also an inflammatory case occurring as a post-traumatic glaucoma in the left eye of a 30-year-old man in perfect health. Four years previously he had been struck in the left eye by a piece of wood, in consequence of which traumatic cataract had developed and glaucoma later supervened. It finally took on the feature of a relapsing congestive glaucoma, the pain being sufficient to disqualify him for his work. The right eye was normal in all respects. The left one was divergent 20 degrees, showed a marked pericorneal injection with slight generalized corneal haze, shallow anterior chamber, several old iritic adhesions and an opaque lens. The tension was 30 mm. and the eye had not even light perception. Trephining was done Oct. 16, 1912, to relieve pain locally. Local anesthesia and morphin internally sufficed to make the operation painless. To-day (one year later) the patient reports, stating that the eye has remained perfectly quiet and that he has worked steadily at making small patterns all through the year. The tension is 20 mm., and the conjunctiva pits deeply on pressure over the trephined spot, showing plainly that filtration is going on perfectly.

The remainder of this series of cases are all non-inflammatory cases of the type with which every one is familiar. They will be briefly recorded.

Case 4.—Oct. 20, 1912, C. H., aged 65, male, carpenter, states that up to three years ago he saw very well with his glasses but later his sight has been growing dim. The patient was, according

to his physician, in good health in every way. Corrected vision equalled 5/30 in each eye. Both eyes were free of any signs of inflammation and no history of an inflammation in either eye could be elicited. The anterior chambers were of fair depth, the media clear and the picture of chronic non-inflammatory glaucoma was complete. The tension was 30 mm. in each eye and the visual fields badly cut down. (See Fig. 1.) After one week, the vision in each eye was 5/10 and tension 20 mm.

This was the first case in which I had the opportunity to use the trephine attached to the dental engine (to be described further on). The quickness and perfectness of its action pleased me very much. With it I used a 2 mm. trephine and on withdrawing it after getting through the sclera the iris prolapsed into the wound in both eyes and a broad iridectomy was secured. Colonel Elliot's experience that a clean, sharply cut disk is likely to give much better results has been borne out in my own few cases, and for this

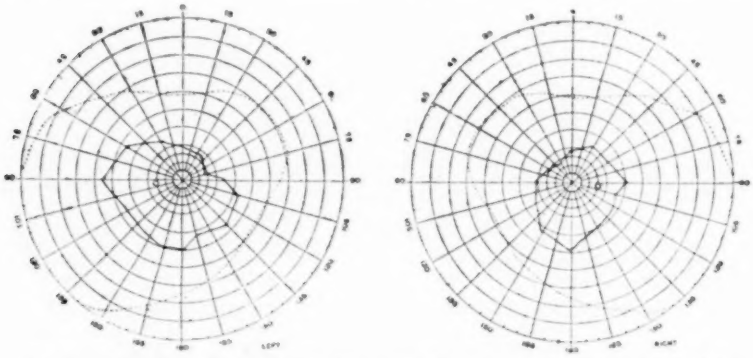


Fig. 1.—C. H. Corrected vision before operation each eye 5/30. Corrected vision after operation each eye, 5/12. Tension = 30 each eye before operation. Tension = 18 each eye after operation. Subsequent report (after 4 months) by his general physician records. Corrected vision R. E. 5/12, L. E. 5/6. Visual fields are those before operation. None after operation obtained.

reason I believe a machine-controlled trephine will eventually become the instrument of choice. Also, I have the feeling that when possible it will be well if we can combine a moderate-sized iridectomy with the sclerostomy, the more so as the small opening in the sclera does not predispose to the untoward accidents that will sometimes attend iridectomy by von Graefe's method.

Case 5.—C. C. F., a mulatto, aged 44. Iridectomy of left eye was done one year previously for acute glaucoma. Vision: right eye, 20/50; left eye, light perception only. Tension: right eye, 30; left eye, 25 to 28. Marked excavation in both optic nerves. General blood-pressure: systolic, 168; diastolic, 120 mm. Trephining done on both eyes. Results good. Visual fields of right

eye before and after operation shown. (Figs. 2 and 3.) Vision one year after operation: right eye, 5/10; left, light perception. Pitting on pressure marked over both sites of operation. Tension: right, 20, and left, 25.

Case 6.—C. T., female, aged 72. Has had cataract in left eye for fifteen years, seemingly without any cause for it. In the last two years has had much congestion of this eye with recurring attacks of pain. The cornea was a trifle hazy, the anterior chamber practically abolished, the pupil 5 mm., irregularly round and immobile. No light perception in the eye. Tension equals 40. Right eye normal in all respects. The left eye in this case represents the type in which it would be practically impossible to get a keratome or even the narrowest Graefe knife into the anterior chamber. Trephining was easily done with the happiest result. One week later the tension was 18 and the patient left for home, 200 miles away.

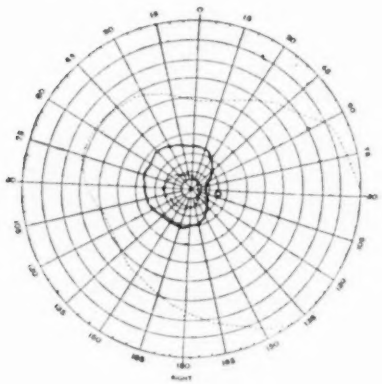


Fig. 2.

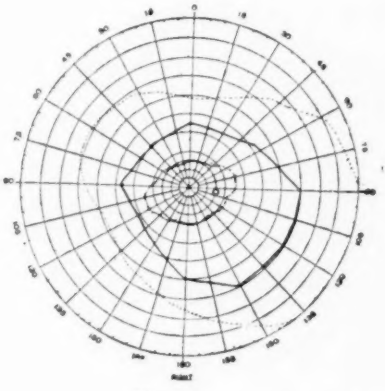


Fig. 3.

Fig. 2.—C. C. F. Vision before operation. R. E. 5/12. Tension = 30. Heavy line form field. Dotted line red field.

Fig. 3.—C. C. F. Vision after operation 5/12 R. E. Tension after operation = 20 R. E. Heavy line form field. Dotted line red field.

Case 7.—J. G., aged 50, had chronic simple glaucoma in both eyes. Vision: right, 5/25; left, 5/30. The media were clear and the ophthalmoscope showed deep pathologic cupping on both sides. The tension was + 2 (no tonometer at hand). Bilateral trephining was uneventful and produced vision of 5/15 in both eyes one month later.

Case 8.—F. D., aged 40, female. Chronic non-inflammatory glaucoma O. U. Had been treated for years with miotics and her vision had been held up by them for at least ten years. Within the past two years it had gradually fallen until, at the time of this observation, it was 1/60 in each eye. The picture was classical with a 5½ mm. pupil, shallow anterior chamber and a 1 to 1½ mm. cup. Tension equals 30 on both sides. Bilateral scle-

rotomy was done without much benefit, tension falling to normal, but at the end of the month the vision remained 1/60 in each eye.

CASE 9.—T. W., aged 65, male. Chronic non-inflammatory glaucoma O. U. Vision: right, 1/60; left, light perception in lower temporal field. Like the preceding case, the features of the case were classical. Tension: right, 24; left, 30. (The visual field before and after operation are shown.) (Figs. 4 and 5). Bilateral trephining was done without incident. Vision one month later: right, 3/60; left, light perception. This was a hopeless-

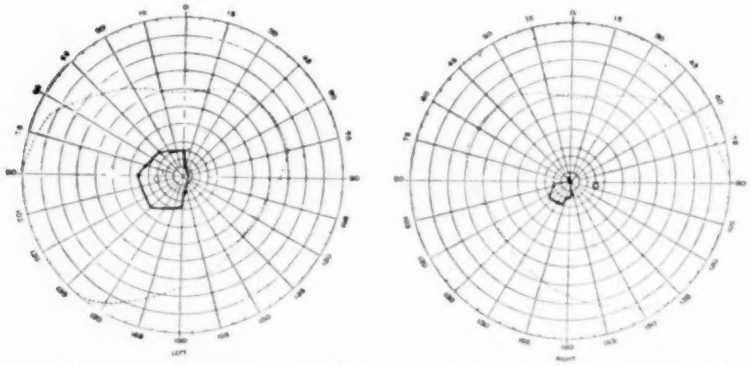


Fig. 4.—T. W. R. E. Before operation vision = L. P. No form field could be elicited. The field shown was taken in a dark room with a candle. L. E. Before operation vision = 1/60. Form field shown.

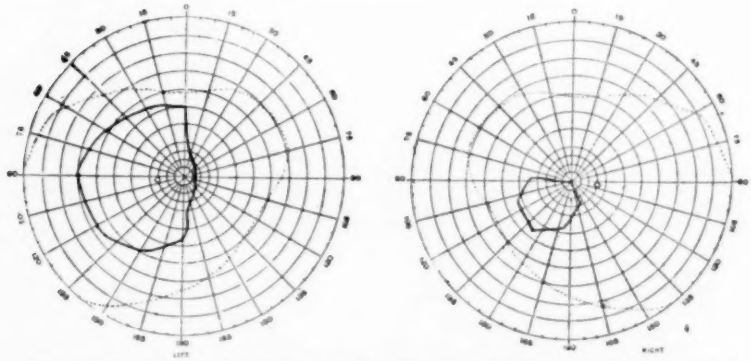


Fig. 5.—R. E. 8 weeks after operation V = hand movements at 1½ feet in lower nasal field. Candle field of this date shown. No form field could be elicited. L. E. 8 weeks after operation V = 3/60. Form field shown.

looking case, and yet his vision was increased three-fold after one month by the operation.

CASE 10.—E. S., male, aged 45. Right eye practically blind, with chronic simple glaucoma for some years. Left eye had been failing for two years. Patient in average good health. Vision: right, 1/2/60; left, 5/25. Typical picture of chronic simple glaucoma in both eyegrounds. Tension: right, 26; left, 24. Double

trephining with iridectomy. Final result: vision: right, 1/2/60 (equals no change); left, 5/10. Final visual field in left eye shown. (Fig. 6.) Final tension: right, 22; left, 20.

Case 11.—C. P., female, Italian, aged 60. Left eye had been failing in vision for five years. Right eye failing only a month or so. Some pain in left eye and rarely in right eye, but no congestive signs of any kind. General health fair. Vision: right, 20/40; left, no light perception. Tension: right, + 1; left, + 4 (no tonometer at hand). Shallow anterior chambers in both eyes. Cornea a trifle hazy in right eye, but marked excavation made out with ophthalmoscope. Left eye secondary cataract. June 2, 1913, double trephining without iridectomy. The conjunctival tissues in this case were thick and much infiltrated. A large flap was made in each eye. During the night the conjunctival flap was swept downward by the upper lid, probably because the patient was restless and uneasy. She did not speak a word of English. Under general anesthesia the flap was slipped back into position

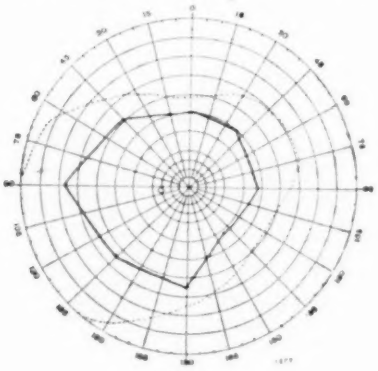


Figure 6.

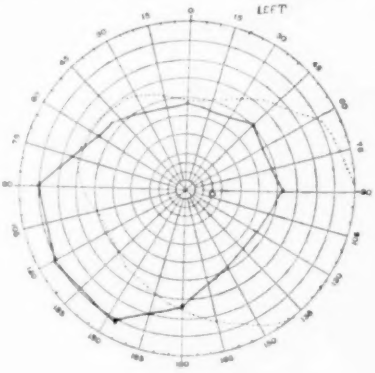


Figure 7.

Fig. 6.—Case 10. Before operation. L. E. Vision = 5/25 partly. Form field shown.

Fig. 7.—Case 10. L. E. 6 weeks after operation. Vision = 5/10. Tension = 20. Form field is of almost full dimensions.

and stitched there with three sutures. The final result was good. Three months later the vision in the right eye was 5/5 and the left eye had remained from the time of operation perfectly quiet. It is our feeling that in heavy infiltrated conjunctival flaps it would be wise to use a suture to keep the flap in position.

Case 12.—L. K., male, tailor, aged 54. Pain in left eye one year. Right eye no pain. Vision: right eye corrected equals 5/9; left eye, light perception. Right eye conjunctiva shows the cicatrices of an old trachoma. The media are clear, however, and there is a deep pathologic cup. Tension normal left eye. Old conjunctival cicatrices, thin pannus upper third of cornea. Lens cataractous. Pupil 5 mm. immobile. Tension + 3. Trephining left eye December, 1912. Large spontaneous hyphemia on the seventh

day after operation. Gradually cleared under dionin and sodium iodid. Healing uneventful and, to our surprise, the pannus cleared away rapidly. One month later vision in the left eye equaled 5/200. Tension normal.

Case 13.—A. T. colored, female, aged 43. Glasses seven years ago, at which time vision and eyegrounds were normal. Sight has been failing for over a year. Vision equaled right, light perception; left, 5/12. Tension: right, 35; left, 30. Chronic simple glaucoma in both eyes.

Aug. 19, 1912, trephined right eye. Uneventful recovery. Aug. 23, 1912, trephined left eye. Patient vomited during the night and showed prolapse of iris the next day. Under chloroform the flap was loosened and the protruding iris excised. The recovery was good and prompt. The visual field of the left eye is shown before operation and one year later when vision in the left eye had risen to 5/7. (Fig. 7.) Tension: right and left, 16. Both cicatrices pit freely.

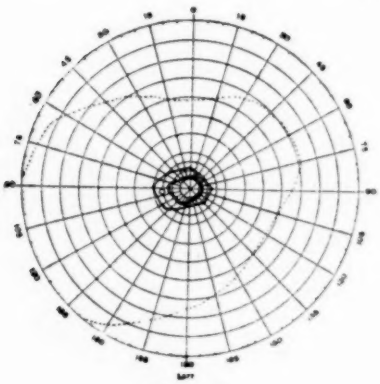


Figure 8.

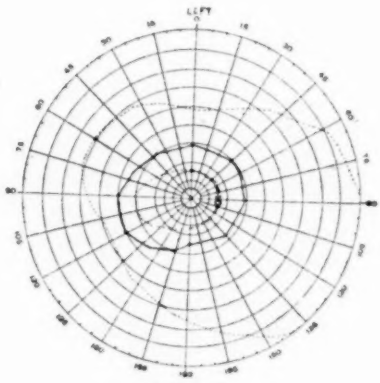


Figure 9.

Fig. 8.—Case 13. L. E. before operation 20/50. Form and red field shown. Heavy line form field.

Fig. 9.—Case 13. L. E. after operation V = 20/30. Much expanded form and red fields shown. Heavy line form field. Dotted line red field.

Case 14.—Miss N., aged 55, nurse, June 17, 1913. Progressive chronic simple glaucoma for ten years at least. Marked failure of vision last three months. Was told at two different hospitals that nothing could be done for her. General health very poor. Seldom goes out of the house. Vision: right, light perception; left, 2/60. No visual field, not even candlefield could be obtained in right eye. Candlefield of left eye shown. (Fig. 8.) Tension: right, 26; left, 28. The eyes were normal anteriorly save for shallow anterior chambers. Pupils 6 mm. and react 1 mm. in each eye. Media are clear; deep (1 to 1½ mm.) pathologic disk excavation in each eye.

June 25, 1913: Double trephining. Large hemorrhage completely filled anterior chamber of right eye, immediately after the

trephine entered the anterior chamber. The lens did not seem to dislocate, so that we concluded the hemorrhage was from an anterior ciliary vessel. Left eye trephining without iridectomy.

One week later: Hyphemia has disappeared from right anterior chamber. Pupils of both eyes 4 mm. and round.

Two months later: Tension: right, 20; left, 18. Vision: right, light perception; left, 4/60, and orientation much improved. At this date a form field could be secured and is shown. (Fig. 9.) The patient now goes out a little by herself, something she has not done for three or four years.

Case 15.—Mrs. H. H., aged 60. A plethoric woman who has always enjoyed quite good health. She is the only glaucomic I have seen in years whose gastric intestinal functions were perfect. She first consulted me in 1906 with a tense hard left eyeball. The anterior chamber was very shallow, the lens somewhat hazy, but the fundus plainly enough seen to detect a deep pathologic cup. Tension of left eye was + 2 and vision equaled 1/200. Right eye was normal anteriorly, media clear; optic nerve showed begin-

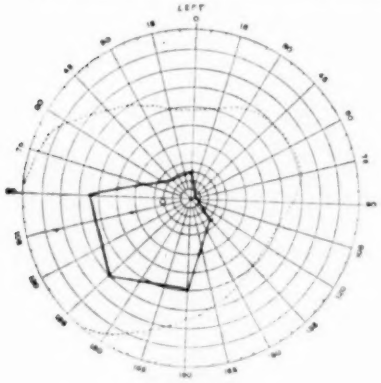


Figure 10.

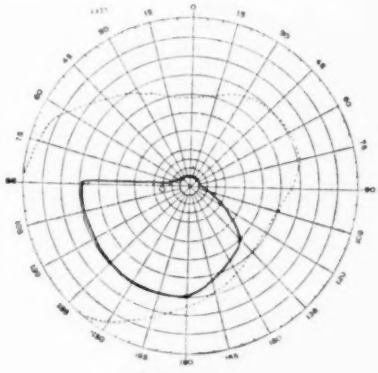


Figure 11.

Fig. 10.—Case 14. L. E. Vision before operation 20/60 slowly. No form field obtainable. Canada field shown.

Fig. 11.—Case 14. L. E. Vision two months after operation 4/60 promptly. A form field was obtained at this date and is shown.

ning pathologic excavation and corrected vision of 5/6. Under miotics, both eyes remained quiet; but about a year ago the left eye began to be painful. By this time there was complete secondary cataract and not even light perception. The right has remained unchanged and all through the seven years has responded beautifully to miotic treatment. Because of the pain in the left eye, tension being 35 mm., a trephining was done May 28, 1913. The iris prolapsed into the scleral opening and a small iridectomy was done. The iris was found very friable and bled freely after the iridectomy, filling the anterior chamber. The eye slowly went into a quiet iritis and was a long time in quieting down. The hyphemia disappeared in about two weeks, but at the end of the month the anterior chamber filled up with blood spontaneously

(the tension rose 10 mm.), showing plainly the characteristics of the degenerative eye that it was. This is the type of eye that almost surely develops expulsive chorioidal hemorrhage after any operation that postulates a large wide corneal wound, such as von Graefe's or La Grange's method. The same was true of two other cases in this series.

This patient's left eye has been three months becoming absolutely quiet, but has been perfectly painless all through the process. Tension now equals 20 mm., although the anterior chamber is practically abolished. I am not at all satisfied with the result in this case, but the patient professes to be entirely so. Would that all ophthalmic patients were as philosophic and optimistic.

CASE 16.—This has proved to be one of the most interesting of the whole series: R. L., colored female, aged 30, stated that up to six months ago both eyes were normal in every way. Three months ago, right eye began to inflame. She was carefully treated by a confrère in a Southern city. After ten weeks of treatment,

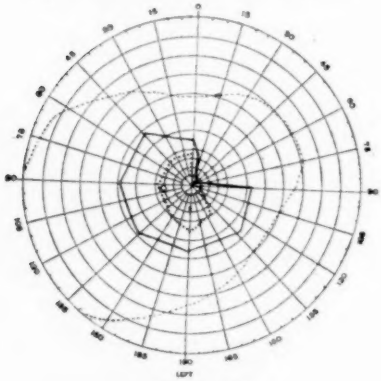


Figure 12.

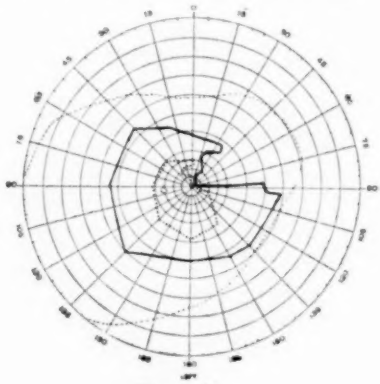


Figure 13.

Fig. 12.—Case 16. L. E. vision before operation = 6/12. Tension = 32. Heavy line form field. Dotted line red field.

Fig. 13.—Case 16. L. E. Vision 3 months after operation equals 6/5. Heavy line form field. Dotted line red field.

she came North and was admitted to my service at the Polyclinic Hospital, July 15, 1913. The right eye was badly congested, stony hard, and tension 45 mm., pupil 7 mm., lens hazy and no fundus view obtainable. The left eye was normal anteriorly, media clear, and the ophthalmoscope revealed a beginning glaucomatous excavation, probably superimposed on an old very large physiologic excavation. Visual field of this date shown. (Fig. 10.) Tension in this eye was 32 mm. and vision 6/12. The Wassermann and von Pirquet reactions were negative, notwithstanding which she was thoroughly mercurialized and miotics used vigorously. The results were unsatisfactory, so that on Aug. 6, 1913 (three weeks after admission) double trephining with iridectomy was done. Atropia was instilled in the left eye before closing it and for three days afterward once a day. For a week everything

went well, but on the ninth day a keratitis punctata began to develop in both eyes. Much of our conjecture was thus settled, as the case took on the classic features of Goldzieher's iritis glaucomatosa. On the twelfth day after operation, the right eye (the degenerate one) developed a large spontaneous intra-ocular hemorrhage, as in the preceding case. Once more I congratulated myself that I had not attempted von Graefe's iridectomy on this eye, as I am persuaded that dire disaster would have attended it. Both eyes were vigorously treated with dionin and atropia locally, and atropia and calomel internally, combined with cabinet baths. The right eye quieted down slowly, and the left eye quickly, so that by Oct. 14, 1913, the cornea was entirely clear and vision had risen to 6/5. The visual field of this day for the left eye is shown and is absolutely characteristic. (Fig. 11.)

Suspecting a latent nasal disorder, she was referred to Dr. Ralph Butler, who reports obstructive ethmoid disease.

Case No.	Which eye	Vision before operation	Vision after operation	Tension before operation	Tension after operation	Result
1	L.	0	0	+4	0	Good
2	L.	2/60	6/12	28	18	Good
3	L.	0	0	30	20	Good
4	R.	5/30	5/10	30	20	Good
	L.	5/30	5/10	30	20	Good
5	R.	5/12	5/10	30	20	Good
	L.	L. P.	L.P.	27	25	No improvement
6	L.	L. P.	L. P.	40	18	Good
7	R.	5/25	5/15	+2	0	Improved
	L.	5/30	5/15	+2	0	Improved
8	R.	1/60	1/60	30	20	No improvement
	L.	1/60	1/60	30	20	No improvement
9	R.	1/60	3/60	24	?	Good
	L.	L. P.	L. P.	30	?	Improved
10	R.	½/60	½/60	26	22	No improvement
	L.	5/25	5/10	24	20	Good
11	R.	5/10	5/7	+1	0	Good
	L.	L. P.	L. P.	+4	+1	No improvement
12	L.	L. P.	5/200	+3	0	Good
13	R.	L. P.	L. P.	35	16	Improved
	L	5/12	5/7	30	16	Good
14	R.	L. P.	L. P.	26	20	Improved
	L.	2/60	4/60	28	18	Good
15	L.	L. P.	L. P.	35	20	Good
16	R.	L. P.	L. P	45	25	No improvement
	L.	5/12	6/5	32	20	Good

To summarize from the foregoing table, twenty-six eyes were operated on by Elliot's method in sixteen subjects. The results are as follows:

In six eyes that were sightless, the seat of absolute glaucoma and in every way degenerated eyes, the patients were rendered free from pain and an eyeball that was cosmetically satisfactory was preserved to them. This is no small matter, as they were all the very type of eyes that are likely to develop expulsive choroidal hemorrhage at the time of operation. Moreover, the teaching in many quarters is that in absolute glaucoma the safe measure is enucleation, an operation from which people instinctively shrink with horror. If trephining will preserve to such patients an eye that will be painless and quiet, it has proved its title as an acceptable operation.

In five other eyes that were sightless there was a small degree of vision gained by the operation, such as hand movements at from 1 to 3 feet.

In the remaining fifteen eyes the results were good, in that the eyes gained considerably in vision and in usefulness. The greatest gain in vision after trephining was from 2/60 to 6/12. The least gain was from 5/12 to 5/10, but this gain was greater than appears on its face, for it was the patient's remaining eye, the fellow eye having been already blinded by chronic simple glaucoma. To-day (after one year) this patient's optic nerve excavation remains just what it was one year ago. His field of vision is enlarged and the cicatrix is filtering nicely. We are therefore justified in feeling that the usefulness of this eye will be preserved to him for many years, which is all that can be claimed for any glaucoma operation.

Some one may ask whether trephining should be done in chronic simple glaucoma and if so when. Our answer would be that so long as a chronic simple glaucomic can be kept in the enjoyment of reading vision by the use of miotics, right living and good general elimination (skin, kidneys and bowels), with a fair-sized visual field and not too marked excavation of the nerve head, one would not be justified in operating. But if the vision falls below this point (5/25 to 5/30) or the visual fields begin to contract, with rise of tension, notwithstanding local and internal treatment, then operation must be seriously considered.

We have under our care patients with chronic simple glaucoma in whom we have preserved practically full vision for from ten to fifteen years under the above outlined drug treatment; and we hold that operation under such conditions would not only be meddlesome surgery, but worse. To let well enough alone is the part of wisdom and the mark of the wise surgeon, but to fail to

proffer surgical aid when things begin to go to the bad in spite of the best medical treatment is to fail in the trust reposed in us.

Our experience in these twenty-six operations has brought with it many lessons.

The first, and most important, is that *we now approach a glaucomatous eye from the surgical standpoint with a hopefulness that we have never enjoyed up to this time.* We frankly confess that up to two years ago we deferred operation in every case of glaucoma that was not acute or fulminant until it became really a last resort — this because of our disastrous experience in three cases with iridectomy.

The second lesson is that the operation is not so brilliant in performance; in fact, is much more tedious of performance than iridectomy. This should not weigh against trephining, for ever and always the safest surgical procedure must be the best, and we

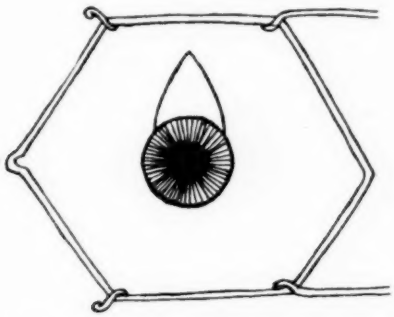


Fig. 14.—Elliot Operation. Improper shaped flap which would likely defeat the purpose of the operation.

believe sclerostomy to be much safer as an operation than iridectomy.

The third lesson is that one must expect a much longer postoperative reaction after trephining than after iridectomy, which does not alter the usual channels of circulation in the eye; while the very essence of sclerocorneal trephining is that it provides a subconjunctival escape for the lymph that has been blocked in the anterior ocular segment. It is our feeling that the prolonged postoperative reaction under the conjunctival flap is due to the presence of the lymph from the anterior chamber, which at first acts almost like a foreign substance (perhaps a biochemical reaction). Gradually the eye becomes adapted to the new channel of filtration and the reaction subsides.

The fourth lesson is that, as Colonel Elliot has already pointed out, "quiet iritis" is not infrequent and that the use of atropin in the eye from the second or third day onward for from ten to twelve days is generally beneficial. We believe that from two to four weeks' preliminary eliminative treatment will often forestall this sequence.

The fifth lesson, which has also been dwelt on by Colonel Elliot in his book, is that a large flap affords the best chance for the establishment of subconjunctival filtration. If the flap is made as in Figure 12, bringing both sides of the flap down to the limbus on either side, the cicatrix which forms is almost sure to interfere with subconjunctival filtration, whereas if the flap is made as in Figure 13 the channel of filtration is likely to occur in the direction shown by the arrows.

The sixth lesson is that if the conjunctival tissues are found thick and infiltrated it is wise to use a suture. The only case in

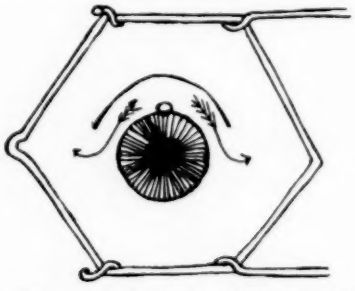


Fig. 15.—Elliot operation. Properly shaped flap permitting subconjunctival filtration around the corners of the flap in the direction indicated by the arrows.

which we found such tissues presented a reversed flap lying over the cornea when inspected the following day, and it was a particularly large flap at that. Under chloroform anesthesia, it was easily sutured in place and the recovery was uneventful.

The seventh lesson is that once the scissors have carried the flap down to or near the limbus the flap should not be held with any forceps at all, but is best held down with some cotton wrapped on a wooden applicator. This quite suffices to hold the flap down while the conjunctival layer of the cornea is being split off and provides a mop in the operator's left hand for ready use.

The eighth lesson is that a clean, sharp cut through the sclera is a great desideratum. To our way of thinking, this is best accomplished by some manner of mechanically rotated trephine. The von Hippel answers this description after a fashion, but it

is a top-heavy device. It may need rewinding of the spring to complete the perforation of the sclera and it somewhat obscures the field of operation. We have therefore had made some straight tubular trephines that are easily slipped into the catch of the ordinary dental engine with its flexible shaft, and this has served our purpose beautifully. Figure 14. The only objection to it is that the dental engine cannot be slipped into our operating-bag and carried to a patient's home or to the hospital. We are therefore having made a small flexible shaft attached to a tiny 8-ounce motor that can be driven by an ordinary dry battery. This whole outfit should fit readily into any one's operating-kit. Lacking this, however, my preference would be for the von Hippel or Gradle

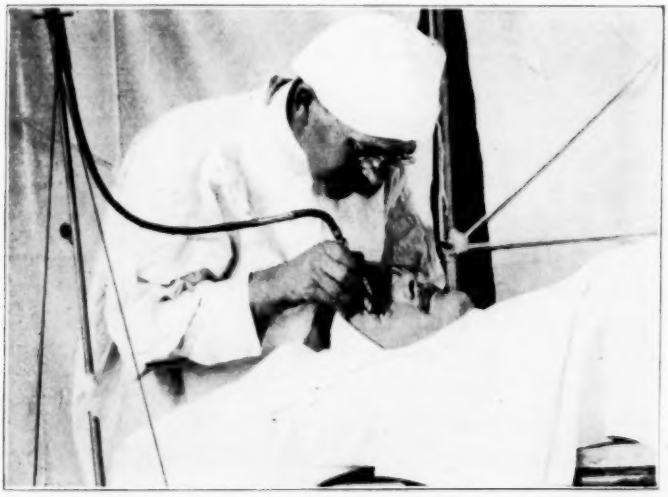


Fig. 16.—Tubular trephine mounted in the handle of an ordinary dental engine attached to a flexible shaft. It it held in the hand like a lead pencil.

trephine and last for the hand trephine. All trephines should be as carefully cleaned after an operation as a gun barrel, and lubricated with a preservative oil, such as 3-in-1.

The ninth lesson is that one can hardly split off the conjunctival layer of the cornea too far forward to facilitate accurate placement of the trephine. Ducamp's recent researches[1] on fistulation of the cornea in animals is extremely interesting in this connection.[2] Also the figures of Rochon-Duvigneaud as to the

1. La Trepanation corneo-sclerale d'Elliot; etude technique recherches anomatique et experimentalles, Paris, Vigot y freres, 1913.
2. See also Arthur Thomson: The Gross Anatomy of the Filtration Angle of the Human Eye, Ophthalmoscope, September, 1910.

dimensions of the angle of the anterior chamber in man, bear on this point.[3] His figures are as follows: Between the upper end of the vertical axis of the cornea and the angle of the anterior chamber, 2.25 mm.; between the lower end of the vertical axis and the angle of the chamber, 2 mm., and between the nasal or temporal end of the horizontal axis and the angle of the chamber 1.25 mm. Manifestly the upper angle of the chamber is therefore most accessible. Descemet's membrane must be cut through if possible and we believe this is much more likely to occur if a mechanically operated rapidly rotating trephine is used than if a hand trephine is employed.

The tenth lesson is that a 2 mm. trephine has proved more serviceable than a 1 mm. one. This is contrary to Elliot's tremendous experience, but we hold to our own conclusion for the present, feeling that an iridectomy can be much better performed through a 2 mm. than through a 1 mm. opening. Moreover, if the scleral disk sticks it is much easier to disengage a 2 mm. disk with the forceps and scissors than a 1 mm. disk and there is less likelihood of leaving some scleral tissue in this opening.

The eleventh lesson is that intra-ocular hemorrhage will occur in a certain percentage of cases, seeing that the glaucomatous eye is almost always a vascularly degenerated eye. In the presence of trephining, this is an almost negligible factor so far as the integrity of the eyeball is concerned, a claim that even the most ardent advocate of iridectomy cannot advance for that operation.

It is therefore our feeling that sclerocorneal trephining (sclerostomy) has come to stay; that it is by all odds the safest operation for glaucoma in the hands of the neophyte, that, if this postulate is correct, many more prophylactic operations for glaucoma may be done now than have been done in the past. And, if this operation is the safest one in the hands of the operator of small experience, is it not reasonable to push the argument further and hold that it is therefore the operation of greatest safety under the guidance of the operator of large and long experience? Time only can bring a just and full judgment of this latest method for the surgical control of glaucoma. Meanwhile let us heed the words of Paul to "think on these things" and to "prove all things and hold fast that which is good."

1212 Spruce Street.

3. Ophthalmoscope, October, 1913.

DISCUSSION ON PAPERS OF DRS. ELLIOT, REMMEN, RISLEY, LAMB AND REBER

DR. ALLEN GREENWOOD, Boston: I want to discuss the papers of both Drs. Reber and Lamb. I think we owe a tremendous debt of gratitude to Colonel Elliot for giving to us the safest operation for glaucoma, or, I should say, the safest operation for the production of a fistulous cicatrix, and also to LaGrange for showing that it is possible to make such a cicatrix.

A few weeks after LaGrange made his operation public, I began to perform it and have used it up to within recent time, and have performed twenty-five of the LaGrange operations because of the excellent results obtained—more excellent than I had ever obtained from simple iridectomy. Lately I have performed Colonel Elliot's operation, using Gradle's trephine, which is a very handy instrument. The cicatrix obtained seemed safer than the LaGrange operation. I hope to do twenty-five of these to compare with my former twenty-five with the LaGrange. Of course, when placed by the 970 of Elliot they will be of small moment, but of some value.

With regard to the use of pilocarpin or eserin, or both, I think the use of these drugs has not been as frequent as it should be. I am surprised, in looking over my records, to find how many times I prescribed pilocarpin to be used at bedtime in the class of cases where there was no actual evidence of glaucoma, but by some intuition you felt it might at some time be precipitated. The relief you get in such patients from the discomforts of the eye-strain by the use every night of a weak solution of pilocarpin is great; and I agree with Dr. Lamb in his conclusion that we have in the myotics a very helpful thing.

DR. REBER: What is a weak solution of pilocarpin?

DR. GREENWOOD: For what I sometimes call tonic drops, I use a 1.10 per cent. solution of pilocarpin. Of course in the slight increased tension of an imminent glaucoma, I use a much stronger solution, that is a 1.5 per cent. solution. I know that many others use a weak solution of eserin for the same purpose. I have confined myself to pilocarpin, reserving eserin for the more distinctly glaucomatous conditions.

DR. BANISTER, Omaha: I have only a few remarks to make with reference to the scholarly paper of Dr. Risley.

Having for some time been interested in the subject of auto-intoxication, I have been led into the same line of thought relative to its relation to glaucoma as expressed by Dr. Risley. The effects of defective metabolism in causing various pathological conditions are now occupying a very prominent position in the professional mind. The term auto-intoxication simply means a condition of toxemia resulting from such defective metabolic processes. This applies especially to endogenous auto-intoxication.

One of the first effects of toxemia, of whatever type, if long continued, is disease of the blood-vessels. The iris, ciliary body and chorioid constituting the uveal tract are wonderfully rich in blood-vessels, and we know that in glaucoma the blood-vessels of this tract have always been found to be diseased in cases where accurate laboratory examination has been possible. Is it not possible, therefore, that in consequence of the defective and perverted metabolism of elderly people, a condition of toxemia might result, which might cause vascular disease with inflammation in the ciliary body, and a resulting pressure forward of the root of the iris with adhesions of a type to involve the filtration angle and to obstruct the canal of Schlemm?

Such a pathological sequence might be one of the causes of glaucoma, and this might especially occur in the forms of auto-intoxication associated with defective uric-acid metabolism, as in gout and allied states.

Dr. Edward Jackson, Denver: I was struck with Dr. Risley's repeated reference to increased tension in different forms of uveitis. This association never had full weight with me until I had used the tonometer in various forms of iritis. I was astonished and at first alarmed to find the tension running 50 mm. and upward. But I am not so alarmed by it now, since I have watched these cases run an ordinary course of chorioiditis or iritis to full recovery.

For the Elliot operation I have tried to make a conjunctival flap by a single slightly curved incision, not so much curved as to be parallel to the corneal limbus, and about 8 to 10 mm. long, pulling the conjunctiva down out of the way with a very broad-ended forceps. I have used the advancement forceps satisfactorily, putting the portion of the blade that seizes the flap parallel to the upper margin of the cornea. I have never button-holed through the flap. This is a flap that does not need a suture. I appreciate the importance of getting rid of all loose episcleral tissue; and I have tried to have the trephine cut into the clear cornea, about one-half or one-quarter of the diameter of the opening.

The operation is one I feel less anxiety in doing than an iridectomy. I have not given up iridectomy, however, in those cases where it has served me so admirably, in acute cases of exacerbation of glaucoma.

Dr. Gradle, Chicago: I am still optimistic enough to believe that the day will come when we can treat glaucoma and cure it on an etiological basis, and that modern operative procedures are merely a bridge between the pre-Graefian period and this millenium. Certainly, the trephining operation of Elliot is one of the best bridges yet built.

Dr. Reber neglected to mention the great advantages that this operation possesses over iridectomy and that is in the optical result. We have all seen perfectly performed iridectomies reduce vision to one-half or even one-third, without any possible explanation. We have all had patients complain of dazzling and inability to read for any time after iridectomy. These disadvantages are probably due to the loss of the sphincter area of the iris, and circles of diffusion in the retina, and loss of the so-called "false accommodation," or accommodation by pupillary contraction. On the other hand, this operation possesses a danger that is still comparatively unknown, and that is the so-called "late infection." This was first described by Kuhnt and there have been now nineteen cases reported. The infection of the ocular contents, usually in the form of a panophthalmitis, occurs weeks or months after the completion of a successful trephining and results from a purulent conjunctivitis. The organisms pass through the conjunctiva, as is usual in such infections, and first infect the tissue lining the filtering cicatrix. I believe that this danger can be avoided in one of two ways: first, we must make the conjunctival flap purely conjunctival, leaving the episcleral tissue in place; and second, give the patients urotropin for use as a prophylactic during the earliest stages of any conjunctivitis.

The quiet iritis mentioned by Colonel Elliot may not be so unfavorable. In cases of absolute glaucoma, this complication, which is very easy to control by the use of sodium salicylate, may be permitted to exist for a week or even more until the tension is down to a point where it will stay down. For we know by clinical experience that the tension is not apt to rise after such an attack of quiet iritis.

In glaucoma simplex, although the Elliot operation gives excellent results, I prefer to attempt the cyclodialysis. This is so simple, absolutely without danger and so efficient in so many cases, that I prefer to reserve the more serious trephining for a later stage should the simple operation prove inefficient.

The histo-anatomical pictures of trephined eyes are extremely interesting. (Plates of the pathological pictures presented.) Several eyes, enucleated from three to six months after operation (death from intercurrent causes), have been examined and the conclusions drawn seem to be unanimous. Where the operation was followed by a good result, the filtering channel is lined throughout by a pigmented epithelium, that seems to be a new growth, advancing from the cut edges of the uvea. Where this tissue failed to proliferate, the scar closed and the operation was fruitless. Where the iris was not incised or excised, but allowed to prolapse into the scleral channel, there was a new growth of connective tissue, completely occluding the passage.

I would like to ask Colonel Elliot several questions: What does he do in those cases where the iris rests against the posterior surface of the cornea and the anterior chamber is not restored? Does he consider it a great disadvantage to make the iridectomy so peripheral as to slightly injure the ciliary body during this step? How does he make his iridectomy; by excising the iris that prolapses after the trephining of the sclera, or by reaching into the anterior chamber and making the iridectomy more central?

Dr. Thomas Faith, Chicago: If Dr. Risley comes before you with an apology for his paper, I certainly should blush in the presence of our distinguished colleague with 900 sclerectomies in his belt. My experience with the operation is limited to seven cases—six chronic and one acute. Two were in eyes previously blind from glaucoma, and none of the cases had been previously operated by iridectomy or other methods. In all of the cases, iridectomy was made a part of the operation.

In two cases a mild iritis followed operation. Two cases had rapid increase of lens opacity and one had subsequently a complete detachment of the retina.

Tension was reduced below 30 with one exception, that of the complete detachment in which the tension returned some weeks after operation. In that case the tension ranged from 36 to 44 after detachment occurred. There was no pain in any of the cases subsequent to operation except in the case of detachment. In four cases the Gradle trephine was used, while in three cases another form of trephine was used, the name of which I am not familiar. Stitches were used in all cases. In all cases I attempted to get as far forward of the limbus as possible. In none of the cases did I have difficulty with the reforming of the anterior chamber. In one case for two days the iris seemed pushed up against the cornea but the chamber reformed as soon as could be expected.

Of course I have no right to express an opinion after so limited an experience, but the operation appeals to me as being much simpler than the ordinary iridectomy and we get the effect of tapping the chamber as well as an iridectomy: and it seems to me that to any one familiar with the technic of operative work on the globe, this operation can be accomplished much more easily than iridectomy.

Dr. Eller: Is it advantageous to have the conjunctiva only in the flap?

Dr. Gradle, Chicago: It is advocated by Kuhnt of Bonn, with the idea there would be a resistance to infection by the episcleral tissue rather than if new granular tissue were formed.

DR. P. F. CALHOUN, Atlanta: My experience in trephining is limited to twenty-five cases and in all of the operations but one the healing and results have been satisfactory. This was a delay in the restoration of the anterior chamber for two weeks. After reading Colonel Elliot's book and the chapter on such complications, my anxiety was relieved, and the final result in this case was excellent.

I believe he told us yesterday that the application of a 2 per cent. solution of nitrate of silver to the wound was of great benefit. This answers Dr. Gradle's question.

DR. LANCASTER: Why, in glaucoma after cataract extraction, does not Colonel Elliot trephine if there is a free opening between anterior and posterior chambers?

DR. F. PARK LEWIS, Buffalo: We all know that in a proportion of cases of glaucoma we have associated with it an opacity of the lens at one stage or another, and after iridectomy this is sometimes increased. In one case of trephining in which it was quite evident that the lens was not touched, the cataract developed more rapidly than it had prior to the trephining. I would like to ask Colonel Elliot and Dr. Risley whether changes of this character are not rather common and on what the pathology depends.

DR. CHARLES C. STUART, Cleveland: My experience is limited to one case, and my greatest difficulty was in stripping up the layers of the cornea. I would ask what instrument is used for that purpose. Dr. Reber spoke of using the trephine in connection with the dental engine. In homes and hospitals could not a plug be used attached to the electric-light fixtures? He speaks of trephining as not to be done in cases of simple chronic glaucoma with little or no rise of tension. And I would ask Colonel Elliot if that is also his dictum.

DR. JOHN O. MCREYNOLDS, Dallas, Tex.: At the recent meeting of the American Medical Association at Minneapolis and the International Congress of Medicine in London and at the British Medical Association at Brighton, I stated that we would never be able to fully express our gratitude to Colonel Elliot for his splendid work on the operative treatment of glaucoma. He has faithfully and forcibly riveted our attention on the great value of establishing a permanent avenue of drainage between the anterior chamber and the general subconjunctival space by means of a small corneoscleral opening. His flap is practically beyond criticism. It is quickly, safely and efficiently made so that we have easy access to the field of drainage. His success and that of others with various forms of trephines abundantly demonstrate the utility of this instrument, and when the instrument is properly selected and properly employed, nothing better seems to be desired.

I have employed the hand trephine recommended by Colonel Elliot and find it very efficient indeed. I have also tried with the highest degree of satisfaction a trephine driven by an electric dental motor and I present herewith some trephines varying in diameter from 1 to 2 mm. They may be provided with a smooth cutting edge or with a serrated edge, but I prefer the former. These were made for me by a dentist friend of mine, Dr. R. L. Schmitt, Dallas, who has remarkable ingenuity along mechanical lines. I have employed the electrical trephine in various forms of glaucoma and with uniformly satisfactory results.

I also wish to present, in this connection, a corneal wedge which I have found very efficient in splitting the cornea after the flap has been arranged according to Elliot's method. This corneal wedge is perfectly sharp only at its point, while its lateral edges assist in splitting the

cornea after the principle of a wedge. The maximum thickness of the wedge is from 1 to 2 mm., preferably the latter. The breadth of the wedge is 4 mm. and its length is 4 mm. It is placed on a handle at an angle of about 135 degrees and is used in splitting the cornea, instead of the Bowman needle which is generally recommended.

I also wish to present a pair of conjunctival forceps for holding the flap after it has been fashioned according to Elliot's directions. The forceps somewhat resemble advancement forceps, but instead of having teeth which likely would cut through the fragile conjunctiva, they have a tongue and grooved grasping surface. This enables you to have your flap at all times thoroughly under your control so that you may be able to accurately direct the splitting of the cornea, and the application of the trephine and without the danger of tearing the conjunctiva or causing injury to the corneal epithelium.

However, it may happen that sometimes all of these advantages may not be available and I wish to present another method of accomplishing the desired result with instruments which every ophthalmic surgeon in the world will always have at hand and with the use of which he is already perfectly familiar. The procedure, briefly is as follows:

1. Prepare the flap in accordance with Elliot's method.

2. Then take a very small, full-curved needle armed with silk thread, and with this needle catch up a bridge of sclerocorneal tissue at the limbus approximately 1½ mm. in length and involving the entire thickness of the sclerocorneal tunic. The direction and extent of this bridge will be determined by the exact location of the drainage window elected by the surgeon which generally would be composed equally of corneal and scleral tissue. After the needle has been drawn through and the thread tied and is grasping securely the sclerocorneal bridge, gentle traction may be exerted on the loop of thread. Then with the point of a small sharp knife make a few circular strokes encompassing the sclerocorneal bridge in the grasp of the thread. And as the knife smoothly and gently makes its way through the entire thickness of the sclerocorneal tissue the little flap will be seen to lift up at its freed margin, while the circular incisions can be continued around until the desired segment is excised. Instead of using a needle and thread a very small sharp but rigid scleral hook resembling a Graefe lens hook may be employed and if at hand may be more easily introduced than the thread.

I have tried with perfect satisfaction this method in both acute and chronic glaucoma. It involves the minimum of pressure or of traction on the globe because the gentle traction of the thread or the hook just counterbalances the gentle pressure of the knife. Hence, there is no tendency to displace the lens by rupture of the zonule, or to cause intra-ocular hemorrhage by a sudden gush of intra-ocular fluids through a large gaping wound. On the contrary, the excision of the flap may be performed with any degree of speed or deliberation or the procedure may be totally arrested at any stage of its performance if conditions should indicate its wisdom. The size, the shape and the location of the drainage window are thoroughly under your control and the window can be entirely removed or left attached on any side desired and to any extent desired.

Dr. John Green, Jr., St. Louis: It is my understanding that in Elliot's earlier operations he made a flap which was practically an inverted V-shape, the ends of the flap terminated at the limbus. I should like to inquire whether he abandoned this flap as the result of secondary increase of tension which could reasonably be ascribed to insufficient drainage around the edges of the flap, or simply on theoretical grounds.

DR. W. REBER (closing discussion): I agree with all Dr. Gradle says regarding the optical result after iridectomy, although I overlooked it in my paper. I think the postoperative astigmatism after the ordinary iridectomy is a more condemnatory feature than anything. Those who recall the statistics of 50,000 cataract operations in Europe, half with and half without iridectomy, will remember that they showed about equal visual results. There is no question in my mind but there will be more astigmatism after iridectomy than after trephining.

I was surprised that Dr. Gradle said he would delay and do a preliminary cyclodialysis in chronic simple glaucoma. Why do two operations when in our judgment one will suffice?

Opacity after trephining was spoken of by Dr. Lewis. This and the so-called quiet iritis may be like phenomena. When we remember that the anterior chamber is punctured, the character of the aqueous is changed. It is more cloudy and may impair the nutrition of the lens. But as Dr. Lewis said, we see this after the simple iridectomy.

I would ask Colonel Elliot about this matter of quiet iritis. That gives me trouble. One case I give in detail in which there was a chronic glaucoma in one eye that had been thoroughly treated with atropin, and the other beginning glaucoma had been treated with eserin. The field was cut down, vision 20/40, and she had all the classical and prodromal signs. She had a negative Wassermann, the luetin test was negative, as was also the tuberculin test. We studied her metabolism from every standpoint. She was sweated and had inunctions, and after three or four weeks of this treatment her vision was 20/40 and her fields were cut down somewhat more. I did a trephining on the left eye, and after several days she developed a most typical keratitis punctata any one could wish to see. It subsided rapidly on treatment with calomel, and atropin internally as well as in the eye. I suspected her nasal cavities, but examination was negative. The keratitis punctata lasted for a week or ten days but the final result was full vision and of 5/5 normal fields in that eye.

With regard to Dr. Stuart's question as to the motor power on the dental engine trephine, it may be anything, foot treadle or motor driven. Any ordinary 30-cell dry battery ought to operate a small one. The quickness and lightness of touch with a mechanically operated trephine cannot be equaled.

I still hold the doctrine that in the presence of tension that is near normal and does not increase, and visual fields that remain steady, I would not operate in chronic simple glaucoma. I would adhere to general elimination and miotic treatment with pilocarpin through the day and eserin at night.

I shall surely use the McReynolds' corneal wedge. I am obliged to take issue with Colonel Elliot as to the expression "splitting the cornea." We simply take off the conjunctival layer, but we do not go deeper in the cornea as this would defeat the purpose of the operation.

I endorse absolutely what has been said by Dr. Lamb and Dr. Greenwood about pilocarpin and eserin, and in a sluggish corneal ulcer that does not behave well I resort to the tonic use of pilocarpin.

DR. LAMB (closing discussion): I would emphasize that I am calling attention to the general use in many diseases of the eye of these drugs as "revulsion" drugs to increase and improve the circulation.

DR. S. D. RISLEY, Philadelphia (closing discussion): I have been impressed by the many expressions regarding the dangers clustering around iridectomy. My own experience does not justify the fears which have

been expressed regarding the liability of cataract as one of its sequelae. I have rarely seen it follow a correctly performed iridectomy. Opacity of the lens is far more likely to occur from disturbance of its nutrition, as one of the sequelae of the chorioidal disease on which the glaucoma depends than for the performance of iridectomy. Dr. Jackson has spoken of the increased tension of the ball in uveal disease.

A careful tonometric study in all cases of uveal disease would be of great value since we know so little of the influence exerted by secretions from an inflamed uvea over the processes of drainage. The design of my paper was to emphasize the clinical relationship between increased tension of the ball and disease of the uveal tract associated with systemic affections of a toxic or infectious character.

I have been gratified by the statement which has been made in the discussion as to the value of weak solutions of eserin as a tonic to congested eyes. I have used for many years these very weak solutions of salicylate of eserin as a bedtime drop in eyes with a congested fundus.

COLONEL ELLIOTT, London, Eng. (closing discussion): Dr. Reber spoke of the ease in execution in iridectomy. It has fallen to my lot to teach a large number of men to operate on the living, and I suppose more than most men living. I say without the slightest hesitation, a man who can do an iridectomy well and neatly is a finished operator and there is nothing to be taught him. It is the most difficult operation I know.

The presentation of the lens was spoken of. This may occur in any glaucoma operation, and is largely due, in Madras, on accountof relaxation of the zonule and consequent shifting of the lens.

In regard to the interval before the chamber fills, that is because it takes the flap a little time to fix firmly down. The channels for the removal of the fluid are so very free at that time that it is impossible for secretion to keep up with excretion.

A patient with an iridectomy done first on one eye, and later a trephining on the other, the only complaint is about "that d.... eye with the coloboma." He is satisfied with everything else, but it gives him blurred vision. I think those who will use a spatula to find out whether you are getting filtration or not will be surprised to find you are getting it every time. People have criticised trephining because it is on trial—only three or four years. While this is perfectly true, those cases seen at intervals show no tendency to change.

LeGrange has cases going further back than I have showing filtration by his method and I have no doubt these cases are going to filter indefinitely.

Inflammatory cases have been spoken of. I urge you to trephine in congestive and acute cases. It is the simplest operation you can do—always with this proviso, that no operation is going to give 100 per cent. of success in acute glaucoma. We would have little time to listen to a man with that claim. Some of the younger men who come to me to learn, I set to work on sightless eyes. We have nothing to lose. In the sightless eye, with the risk of intra-ocular hemorrhage, the moment you find you have it, put the patient back in bed as quickly as possible.

As to medicinal treatment, you have heard the case put by surgeons second to none in the world. Two of your surgeons of world-wide reputation have advised you to use drugs. My feeling is all the other way and I simply give you my reasons. Some years ago I had the experience to have appendicitis. They put me off for one reason and another. I could not do anything, until finally I begged them to take it out and they took it out and then I could walk about like anyone else. The

operation of trephining in an early case is so safe, so simple and so certain that you need not hesitate to advocate it in your cases, for you at once set your patient free and he can go to Kamchatka and not be tied to an ophthalmological surgeon. I speak with the profoundest respect for those who have spoken to-day and whom I hold second to no man alive.

Dr. Reber spoke of the large flap. I find many of the unsatisfactory results have been due to the omission to make the large flap.

I hope a number of you will use the dental engine and publish your results. We found in Madras with the von Hipple trephine, there was a larger percentage of iritis and prolapse than with those of us who did not use the mechanical engine and did not get quite so clean a piece cut out. That is the one question which confronts the dental engine.

Get further away from the ciliary body, as I have advocated. If you are going to use the dental engine, make the trephine hole smaller to start with, and then you get the same effect. If you do not do so, you will not be able to handle the iris complications so safely and so easily.

I would always advise you to trephine over the site of the old iridectomy so as to get rid of iris complication. Trephining for the relief of pain I have had excellent results from.

Another point I am glad to hear mentioned is the infection from the filtration pad. I operated on a lady who is widely known throughout the world as a theosophist. She writes me that at first there was a spot of constant irritation. She treated it with argyrol, massage, etc., and the treatment has brought her much relief. Dr. Remmen spoke of atropin to relieve pain. You may force your uveal tissue through the trephine. You may get good results by using eserin instead of atropin.

It was worth our while to come any distance and listen to Dr. Risley's paper, and it is a source of great gratification to have one I respect so highly confirm my views of the septic origin of glaucoma, which I have been endeavoring to put forward. An interesting thing I have never published, is the filtration you get in the back of the lens. I have seen 550 couched lenses and in these cases you will see the very phenomenon Dr. Risley describes.

Dr. Reber spoke of the prevalence of small eyeballs in glaucoma. A test I saw in Madras: you pull the eyelids open and if the eye is big it comes up and fills the whole of the orbit; but if small, it stands out and you look back through the deep culdesac. You are dealing with small eyes.

Dr. Faith spoke of recurrent tension in a trephined case. I recommend that he retrephine that case.

Dr. Greenwood spoke of LeGrange. His place will ever be great, though many of us will discard his cataract operation as too dangerous.

Dr. Gradle and others have shown their trephines, and I am paralyzed with the magnificent ingenuity of the instruments for trephining. One thing suits one man and another suits another, and each must work with the tools he finds suit him best. We have a most admirable selection from which to choose. I would like this opportunity to ask you gentlemen who have brought out new instruments if you will send to my London address a short description of them and an illustration of them, as I would like to publish the whole of them when I get the opportunity.

Dr. Gradle spoke of the etiologic basis of cure. That is something to look for in the future. As to late infection, Dr. Gradle said if we took the conjunctiva alone we should be safer. I am inclined to think if we would make the flap thicker it would be safer. I may be wrong. As to quiet iritis, we can always master it and keep it in hand. Dr. Gradle spoke of cyclodialysis as a minor operation. I take issue with him there.

I am afraid of the ciliary body and would never touch or interfere with it if I could possibly help it. The years make me more timid and I would run away from it if I could. I hold most strongly, on clinical grounds that what we are to aim at is a foreign-body-free fistula. We do not want anything in it. Get away from the uveal tissue and get a foreign-body free fistula.

Dr. Lewis asked about the changes in the lens. That makes me feel like a pea shaken in a drum. Sometimes it comes on much more rapidly after operations where the lens was not touched. Sometimes it proceeds less rapidly. I do not know what it is, but am satisfied that these cases of long standing with lens changes will proceed more rapidly as the nerve changes. But what it is, is for the etiologist to determine.

Every case you trephine should be watched and you should suspect quiet iritis in every one. There is no fear provided there is filtration. You can pour atropin into the eye. Do not stop until you are sure the iritis is over. Publish your findings, your failures as well as your successes.

With regard to the keratitis punctata, interference with a septic eye is always a risk. He is coming to you because he is up against blindness and you must take your risks.

Dr. Reber does not believe we split the cornea, and I am sorry I must differ with him. Mr. Sydney Stephenson showed me some cases in which he got sections and it was manifest that the splitting had split up the lamina, and Stephenson will publish these cases soon.

BILATERAL COLOBOMA OF THE LENS

REPORT OF THREE CASES, ONE COMPLICATED WITH CATARACTS; OPERATION

F. PHINIZY CALHOUN, A.B., M.D.
ATLANTA, GA.

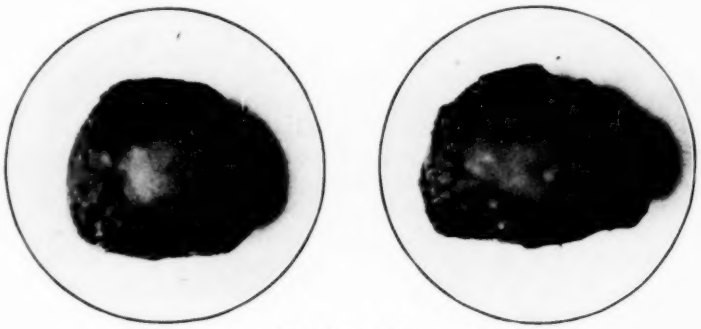
Coloboma of the lens is a comparatively rare eye abnormality and Parsons thinks the condition often undiagnosed, especially in its slighter forms. One case in question, being a bilateral deformity complicated with senile cataracts which were easily removed, is an unusual experience with me and one which I do not find recorded.

CASE 1.—*History.*—B. C. K., aged 61, a farmer of North Georgia, consulted me April 4, 1911, complaining of failing vision for four years in the right eye and three years in the left. He states that up to this time he had useful vision and considered it good. His father, a man of 85 years, had cataracts, but they were not removed, as the family thought he was too old to undergo an operation. The patient has a family of four children and states, as well as a son and daughter who accompanied him, that the sight of all of the children was good. The patient was a healthy man of good habits, except that he took an occasional drink and was a constant chewer of tobacco. He gave no history of ever having had an ocular injury or an inflammation. The examination at this visit showed slightly tremulous, light gray irides (iridodonesis), mature senile cataracts (nuclear), very defective light perception and normal tension. The pupils were dilated with homatropin and nothing unusual was noticed. I did not suspect a coloboma of the lens, for it was my impression that I was dealing with a case either of congenital lens dislocation (although no displacement was detected) or possibly an intraocular degeneration with fluid vitreous, giving as symptoms poor light perception and a tremulous iris. But on account of the condition being bilateral, this latter diagnosis was exceedingly doubtful. Atropin dilation and a more careful search might have possibly revealed the abnormality later found by operation. A future examination of the left eye, however, did not show anything different from the first examination.

On account of poor light perception and an iridodonesis, I did not advise an operation, but I prescribed strychnin and syrup of hydriodic acid and insisted that he reduce the quantity of tobacco and to return later. Seven months later he returned with the same condition, except for a decided improvement in the perception of light; he therefore must have had a tobacco neuritis. I then performed a preliminary iridectomy in the right eye and one month later he returned for the extraction. Believing the lens condition was caused from a congenital dislocation, it occurred

to me that it might be pushed further back in the vitreous when pressure was made to deliver it and that some other procedure must be adopted to prevent this. After my section, with the capsule forceps, I gave the lens a rotary twist, making traction downward, my object being to rupture the zonule above. Whether this was of any benefit or not, the lens was delivered easily and cleanly, and the ultimate recovery was quick, quiet and uneventful. There was a decided deficiency in the lower segment of the lens. Ultimately 20/30 vision was obtained with a + 12 S.

In March, 1912, he returned for the operation on the left eye and as the first operation was uneventful and easy, I did not perform a preliminary iridectomy, but made a combined extraction, manipulating the lens with the capsule forceps in the same manner as was done in the right eye. This operation was also successful and uneventful. Vision in the left eye was 20/40, with + 11 = + 2.50 x 15 two weeks after the operation.



Case 1.—× 4 +

The specimen showed the same missing segment below, but much smaller. The lenses were of the sclerotic type with practically no cortical substance, and after hardening in 10 per cent. formalin solution, the diameters measured as follows: right 9 mm. horizontal x 6½ mm. vertical; left, 8 mm. horizontal x 6½ mm. vertical.

Case 2.—J. L. S., male, aged 7, has worn glasses for three years on account of defective vision. The eyes of his father and mother were normal except for slight errors in their refraction. The past history of the patient was negative for ocular injuries or inflammation. The patient was wearing — 7 S. in each eye, which were prescribed by a prominent Philadelphia confrère. The irides were light gray and the left very slightly tremulous. The corneae measured 12 mm. in their horizontal diameters. Vision: right, 6/200; left, 2/200. Homatropin solution used for two hours showed pupils well dilated, and the lens and fundus changes were distinctly seen. In the right eye there was seen four "punched-out" places in the nasal and inferior periphery of the lens; the most inferior one was largest and through it a bright red fundus

reflex could be detected, whereas the upper three were less defined and partly covered by the pupillary margin of the iris. The fundus was characteristic of high myopia with mild changes in the chorioid at the posterior pole of the globe. The left eye was more interesting, and for a while I was in doubt if the abnormality in the lens was one of coloboma or ectopia. There was a large, bright, crescent-shaped opening downward and inward, through which the fundus could be studied with fair accuracy. No remnants of the suspensory ligament was seen in this opening; in fact, at no place could it be found. The fundus of this eye was also characteristic of high myopia with chorioiditis. With a — 18 S vision was improved to 20/100 in the right eye and unimproved in the left; — 10 Ss were prescribed.

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The etiology of this condition I do not think is perfectly clear. There is much discussion as to whether it is due to fetal inflammation or arrest of development, a teratologic phenomenon, if you choose. There seems to be a disposition to return to this theory. The most recent work done in this direction is that of Pagenstecher who fed naphthalin to rabbits. The period of gestation in rabbits is thirty-two days. By feeding them this substance after the twelfth day, all sorts of cataracts resulted, but no coloboma forms unless naphthalin is fed before the twelfth day, when the fetal cleft closes and then all manner of colobomata were seen. It was uncanny. It almost seemed that they could produce at will, a certain specified arrested development.

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The cause of these colobomata is of course an embryological malformation. The first cause to be thought of would be a possible short-circuiting of the edge of the lens by one of the vessels of the tunica lentis vasculosa, or by connective tissue. The lens is one of the first organs developed and its vascular system is well advanced before the zonule fibers exist. Hence, one of the vessels could easily bend over the developing edge of the lens and for some reason refuse to yield to the rapid growth of the lens itself. This would produce a notch which could easily remain throughout life, in the form of the coloboma described. Another possibility that must be considered is the failure of some of the zonule fibers to develop. The tension of these fibers maintains the shape of the lens and any relaxation allows the lens to contract on itself. If a few of these fibers should fail to develop there would be nothing at this point to keep the rounded shape of the lens intact and a notch would result. Of course, both of these explanations are merely theoretical, based on embryological facts.

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A PLEA FOR ITS MORE GENERAL ADOPTION

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BOSTON

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that the glass ball was introduced with difficulty and the patient warned that it would probably not be retained.

The good results of these operations, particularly from a cosmetic standpoint, are produced by two causes: First and foremost, the use of a sufficiently large sphere for the implantation purpose. Having occasion twelve years ago to remove the eye of a 6-month-old baby, it seemed to the author that if a sphere as large as possible were implanted in Tenon's capsule, it might prevent the lack of orbital tissue development which is supposed to follow such early enucleation. It was found that the largest size of the ordinary Mules' spheres which could then be obtained from the instrument makers was easily introduced into Tenon's capsule, and this has ever since been retained, giving the child at the present time a far better orbit and appearance than would have been possible otherwise.

With this in mind I was early convinced that it was better to implant a much larger sphere than was commonly used for these

Fig. 1.—O. S. removed Sept. 20, 1913; 22 mm. glass sphere implanted.

operations in adults, so through a maker of artificial eyes a number of spheres were obtained varying from 18 to 24 mm. in diameter. During the past few years I find that I am using either a 20 or 22 mm. sphere in all cases, preferably the latter. In one case where the patient had a buphthalmic eye the 24 mm. sphere was used. The greatest advantage which the author has found from the use of these large spheres has been the absolute lack of sinking in of the upper part of the upper lid. Patients with these large spheres implanted and a prothesis in place show, when the eyes are closed, practically the same prominence of the upper lid in both. It must be readily seen that such a condition adds a great deal to the cosmetic result.

A number of my confrères who have seen the 20 and 22 mm. spheres introduced have, beforehand, expressed skepticism as to the possibility of introducing them within the inner sac of Tenon's capsule, but all, I think, have been convinced of its possibility and

been surprised at the ease with which even the 22 mm. sphere can be put in and retained. It is very easy to see that with the muscles properly sutured together in front of such a large sphere it would be very difficult for it to slip out between them, and this probably accounts partly for the large measure of success in the prevention of extrusion in these cases.

The second cause of the good results, both from the cosmetic standpoint and the prevention of extrusion, is the careful following out of the technic described below.

After freeing the conjunctiva thoroughly from the globe, making the conjunctival cuts as close to the cornea as possible, the capsule of Tenon is opened close to the border of one of the recti muscles. This muscle is then caught up on a hook and the capsule of Tenon freed from it some little distance back. Then a stitch of No. 0 or No. 1 silk is passed through the muscle tendon, weaving the needle in and out several times. This suture is then tied in a surgeon's knot, and the free ends caught in a snapper. Each muscle

Fig. 2.—O. S. removed 13 years ago; 16 mm. glass spheres implanted.

is treated in the same way so that all four recti have a separate stitch firmly imbedded in the tissues near their cut extremities. The eyeball is then freed in the usual manner, care being taken not to cut the nerve far enough back to injure the central vessels before they enter, and carefully cutting all attached tissues close to the globe. After the eyeball has been removed it is very easy to find the cut edges of Tenon's capsule, and one cannot help being surprised on finding what a well-marked membrane Tenon's capsule is and what a clearly defined sac is obtained by holding up the edges. The sphere is then introduced and the edges of Tenon's capsule brought together by over-and-over stitches of catgut or by a purse-string suture of the same material.

Ophthalmologists who have taken a course with me on operative surgery of the eye, at the Harvard Post-Graduate School, have expressed their surprise on discovering how distinct a membranous sac could be demonstrated on the cadaver and how easily a 22 mm.

sphere could be introduced and have the edges of the sac sutured over it. This step in the operation seems to me to be very important, in that it insures that the sphere is entirely surrounded by a fibrous membrane, the best tissue to form an encysting material.

The introduction of the sphere serves another purpose just at this moment, in that it usually prevents any further hemorrhage. Following this the muscles are fastened together, the superior and inferior being attached to each other first, and then the externus and internus. At this point, if one wishes, a single suture can be passed through the joining of all four of the muscles in order to secure a more perfect position.

Then, lastly, comes the suturing of the conjunctiva, which in my opinion should *never* be by the purse-string method. The shortest portions of the ocular conjunctiva, as we know, are those from the outer and inner canthus to the limbus, while the portion of the ocular conjunctiva above and below is very much more abundant. A purse-string suture, therefore, has a tendency to shorten the con-

Fig. 3.—Same as Figure 1.

junctival sac laterally where such a shortening can be least well afforded. So, it is far better to suture the conjunctiva with two or three interrupted sutures placed at right angles to the palpebral fissure. The lids are then closed, sterile vaselin applied and many layers of gauze bound on with a pressure bandage.

It must be evident that the carrying out of the above procedures, with the use of the large-sized spheres, will insure their retention in the vast mapority of cases, and also their retention within the cone formed by the four recti muscles.

A word regarding the material to be implanted. Recently it was my good fortune to be able to remove a glass sphere that had been implanted five years and find it in just as good condition as the day it was introduced. There was left behind a thin-walled cyst, having a lining membrane just as smooth and shining as the glass sphere removed, so that it is my belief that a glass sphere properly encysted in Tenon's capsule will remain in statu quo, and this is borne out by the fact that in none of my cases has the glass

sphere shown any signs of being absorbed even in the cases of over thirteen years' standing. These glass spheres should be made from lead free glass. The hollow gold or platinum sphere has some advantages, but for most cases the cheapness and lightness of the glass would seem to outweigh these. Paraffin, as formerly advocated by some authors, seems to have fallen into disrepute, as has the sponge.

Recently Spratt has urged the use of a ball of autogenous fat for implantation, but this necessitates an additional wound on the patient and a material lengthening of the operation, while it must follow that as the patient ages the fat will absorb to some extent and allow the upper lid to sink in. In advocating the ball of fat, Spratt claims as one of its chief advantages over gold or glass, that it will not slip around. The large spheres here recommended do not slip around after the suturing of Tenon's capsule.

While it is, of course, far better to have the sphere implanted into Tenon's capsule and the cone of muscles, still it is perfectly possible to make a pocket in an orbit from which an eye has at some previous time been removed, and implant a glass ball within the orbital tissues, and thus much improve the appearance of the patient. As an illustration of this the following case may be cited:

Case 1.—A few years ago an otherwise attractive young girl came to me with a very disfiguring sightless eye, and was advised to have it removed and a glass ball implanted. Through the advice of friends, however, she went to one of the charitable institutions of the city and had a simple enucleation done. Three months later she returned to me with the upper lid very sunken in and a very small immovable prothesis in place. She was very much displeased with her appearance and begged that something should be done to improve it. I made a longitudinal cut in the anterior orbital tissues extending from the caruncle to within 2 mm. of the outer canthus, and then by opening scissor blades in the wound, made a large pocket in the orbit rather more above the center than below, so as to insure the pushing out of the upper lid. An 18 mm. glass sphere was then introduced and the cut in the orbital tissue sutured. two weeks later she was able to have introduced a prothesis nearly twice the size of the old one and with this in place the upper lid was pushed out almost to the same level as the other. It is needless to say that her general appearance was vastly improved.

SUMMARY

Have several of the large-sized spheres on hand and use a 22 mm. one if possible. Suture Tenon's capsule over the sphere so that it completely covers it. Then, and not till then, suture the muscles together, following this by interrupted suturing of the conjunctiva, placing these last sutures at right angles to the palpebral fissure.

DISCUSSION

Dr. W. Reber, Philadelphia: When we consider that the dimension of the normal eye is about 23 mm., we are not surprised by the size of the ball Dr. Greenwood introduces. I have used 16 to 18 mm. balls of gold and have some made of platinum, as less likely to be acted on by the secretions. We have our choice of enucleation, evisceration, implantation or to do the old Critchett operation, as we choose. Simple enucleation has its disadvantages as pointed out. Some claim that if the plain Critchett operation is done we get a stump which we can use nicely. One of the best results I ever saw occurred in the work of Sweet and myself. Implantation has a wider field of usefulness than enucleation alone. Much has been said about the deleterious action of the secretions on the glass ball, and I am glad to have the testimony of Dr. Greenwood after five years.

The reaction from implantation is greater than from simple enucleation, and from evisceration it is greater than implantation. After implantation we do not use any dressing other than a little gauze pad and two adhesive strips and ice immediately.

The cosmetic effect is of great importance, and I agree that the more the upper lid can be maintained at the level of the corresponding eye, the better. Another thing is the rotation of the eye, and here the rotations can be taken just as well as with the normal eye. Dr. Sweet's published cases show a marked gain of rotation in nearly every case.

Dr. E. L. Jones, Cumberland: I have not done many enucleations and implantations, but long since learned that you require a certain kind of glass, and it occurred to me that being so resistant to all kinds of chemicals perhaps the simple agate marbles might be used. This is just as resistant to any kind of chemical action as gold or platinum. Two agate marbles so inserted about four years ago have remained without trouble. The weight of a solid sphere is of no consequence and is not felt.

Dr. W. B. Lancaster, Boston: I reiterate what Dr. Greenwood has said about the small amount of reaction which follows this operation as he does it, but he is too modest about his technic. It would be worth your while to see the operation done by him. It must be done neatly and aseptically and then you get little reaction.

Dr. Reber spoke about the normal eyeball being 23 to 25 mm. in diameter, and that consequently it would be easy to put in a glass ball 20 to 22 mm. in diameter. If the globe is 23 to 25 mm. in diameter it is 75 to 80 mm. in circumference. From that we must deduct 10 mm. for the cornea and 5 or 6 mm. on each side of the cornea before we get enough capsule of Tenon to pick up and sew together. This makes 20 to 24 mm. to deduct from 75 to 80 mm., leaving not much over 55 mm., perhaps less, for the circumference of the sac into which the glass ball is to go. This corresponds to a diameter of 18 mm. or less. How, then, can we insert a 20 to 22 mm. ball? Evidently the capsule gives. Recall how delicate it is. So does the orbital fat give. It is very soft and fluid-like in some parts of the orbit, especially back of the eye. It readily yields when pressed on by the glass ball, for the various septa and delicate fasciae in which it is enmeshed have been disturbed by the cutting of the optic nerve and oblique muscles, as has the capsule itself been more or less cut or punctured by the scissors at the same time. Thus it is easy to see how a ball considerably larger than the original dimensions of the capsule of Tenon would seem to admit can be put in that lymph-space; since, on the one hand, the capsule has been sufficiently incised to make it give the few millimeters necessary, and on the other

hand the orbital fat readily yields to moderate pressure. The torn and cut web or connective tissue and capsule soon cicatrize, forming a firmer support than before.

As Dr. Jackson pointed out in his discussion of a previous paper, the normal eyeball is held in place not chiefly by the capsule of Tenon and the orbital fat like a ball-and-socket joint, but by the oblique muscles, check ligaments, etc. Now when an eye is enucleated in the ordinary way these muscles and ligaments are severed and there is nothing left to support the eye but the orbital fat. But in Dr. Greenwood's method of doing the Frost operation he pays very particular attention to the capsule, which he sutures in a separate layer. The capsule is connected with these ligaments and thus may afford additional support.

At any rate, whatever the explanation, there is no doubt about the fact of the cosmetic superiority of this operation in avoiding the sunken appearance of the lids and artificial eye.

Colonel Elliot, London, Eng.: I would like to make a suggestion as to material in the Mules operation. I had a case of a boy who had a Mules' operation and had a glass ball broken in his eye. I use beeswax and iodoform. You can get in what you want. You can make it any size and it stays in.

Another suggestion, an operation not mentioned here and I deem it one of the most difficult, that is opticociliary neurotomy. I have done twenty or thirty. I invented a hook which goes back and gets out 20 mm. of the optic nerve. In blind, painful eyeballs I think it the best you can get, especially with the poor who cannot afford to get new shells. I have tested it and think well of it.

Dr. H. H. Martin, Savannah, Ga.: I want to ask Dr. Greenwood one or two questions as to the technic, which is not clear to me. I do not understand how Dr. Greenwood sutures the muscles. You did not say whether you took the retention sutures out and put in fresh sutures or simply drew the muscles together with the retention sutures.

I have never done an implantation myself. The Mules operation in my hands has been extremely satisfactory, but there is the ever-present danger of future trouble in the other eye. As soon as I get back home I expect to try an implantation.

Dr. Greenwood (closing discussion): I simply tie the muscle sutures together. I use silk for suturing the muscles. It is buried and stays buried.

I want it understood that I have simply considered this operation where it has been determined to do a complete enucleation.

In regard to the reaction, I had more reaction when I left the eye alone and put on ice immediately than I did when I put on a good compression. If Dr. Reber will try a good compression he will be surprised when he takes it off to see how little reaction there is inside.

In regard to the agate sphere, I like to put in something as light as possible.

With regard to the motion, that is excellent in these cases, but in no case have I ever been able to obtain good outward rotation. There is good downward, upward and inward, but the outward is the most limited of any.

PSYCHIC DISTURBANCES INVOLVING THE EYE

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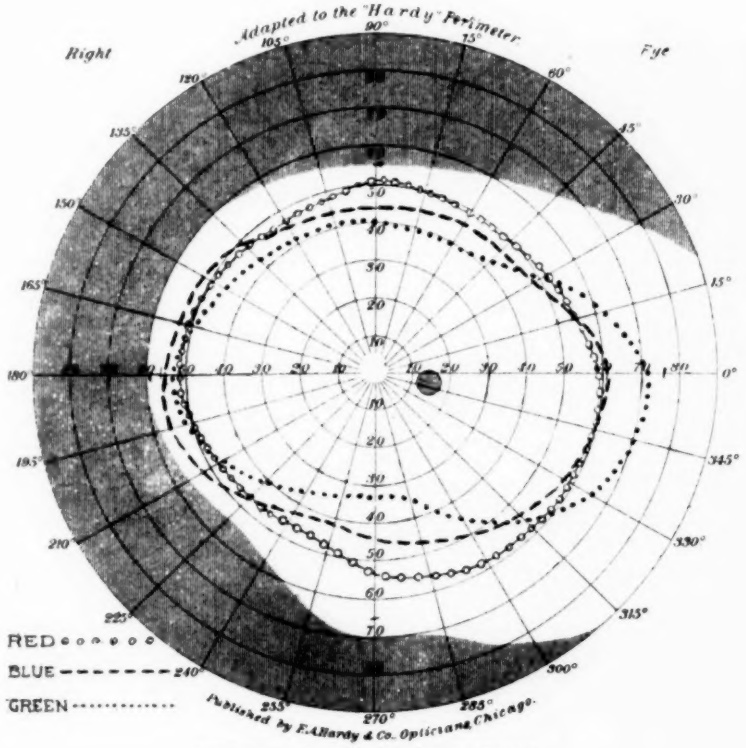
The extraordinary development during the past two decades of various cults whose tenets are based on functional changes produced through the effect of the mind has led the public to accept conclusions which are based on an inadequate knowledge of the data involved, and which are often as unwarranted as they are absurd. It would seem worth while, therefore, to devote a little time to the study of some of the more unusual and striking symptoms which are met, and which are relieved through mental influences, and to differentiate between these and the organic physical changes which under no conditions could be modified by the influence of the mind of the subject either by autosuggestion or by the suggestion of some mind other than his own.

There is doubtless much that we do not understand concerning the effect of the mind on natural bodily conditions, but so much has been carefully investigated and observed, both by the psychologist and therapeutist, that we are in position to-day to differentiate more accurately than ever before between those physical symptoms which may be modified by the mind of the subject and those which cannot. We consider ourselves to be a sane and well-balanced people, but the conditions under which we live, together with the fact that we are naturally highly organized nervously, makes our people, like those of Latin blood, peculiarly susceptible to psychic influences.

Hysteria is not always, as we are sometimes led to believe from the text-book description, an unrepressed expression of emotion associated with convulsive contortions on the part of an excitable woman who has been the victim of a nervous shock. Its manifestations are of more varied character and may be, and frequently are, accompanied by a placidity of demeanor that is quite misleading as to the actual nature of the disturbances from which the subject is suffering. Indeed, not infrequently, the victims of psychoses are exceedingly quiet in manner and appear to be absolutely self-contained. Not infrequently the manifestations of hysteria may be accompanied by actual pathological conditions of greater or less severity; and in these cases the separation of the real from the assumed or imagined symptoms may be a matter of great difficulty. The nervous disturbances which we find may be shown in either exaggerated or in a diminished functional activity. They may be

located in obscure organs and may seemingly be disassociated with any general symptoms of a nervous character.

The importance, then, of this subject to the ophthalmologist lies not only in the fact that the diagnosis must be made in definite and pronounced conditions as to the bearing which the psychic element exerts, but even in ordinary examinations in which there are possibilities of exaggerating or minifying symptoms, this element must be reckoned with. For the range extends from the simplest variations from the normal to those of most pronounced character.



Miss C. G. Psychic blindness. Case 2.

A most interesting case comes to my mind of a woman, in middle life, who had a most complicated musculo-refractive condition, in which high compound spherical cylinders were combined with vertical prisms and in which the patient who had been a sufferer for many years, was restored to a life of usefulness and comfort, but who suddenly developed a severe and persistent headache on which no treatment which was applied seemed to produce the slightest effect. Under the influence of a "Christian science" friend the head-

aches wholly disappeared. In this particular instance, as there was no remaining organic cause to which they could be attributed, her mental state had doubtless an important bearing on her condition. The sense of happiness and comfort which she experienced was the one thing necessary to effect her cure. That this conclusion was warranted by the facts was shown in that, notwithstanding her continued belief in the efficacy of Christian science, she was unable to go without the glasses by which the organic differences in her eyes were adjusted, without suffering great discomfort.

The exaggerated sensation of pain, the inability to perform certain functions, whether of the eye or of any other part of the body, influenced in large degree in those who are susceptible to the mental condition of the subject. After a very small operation on the cornea or on the eye muscles, I have seen patients thrown into a brief epileptiform convulsion, from which they quickly recovered without having any return of a like condition. When about to operate on an elderly lady for cataract, she having an irritable heart and a highly nervous organism, she suddenly became convulsive, with temporary loss of consciousness, but under a stimulant quickly recovered and the operation was finished without accident. I have seen a strong well-developed man fall on the floor with convulsive twitchings of the limbs after the removal of a foreign body from the cornea. Cases of this character are of sufficient frequency and of such a puzzling character as to warrant their very careful consideration, while the more marked cases are sufficiently distinctive to stand in a class by themselves.

There are certain phases of the subject, in the ordinary daily work of the ophthalmologist, which are deceptive unless they are understood. The insistence on the presence of great pain when we know that it cannot exist; the assurance that the sight has diminished when our tests show it to be normal; and, the undue emphasis laid on minor symptoms, all require the nicest discrimination and unless recognized may be most misleading. Major cases of hysterical functional disturbances are by no means so common. The following is a most interesting case in point.

HYSTERICAL AMBLYOPIA

A little girl 10 years old was brought to my office by her father with the statement that she had suddenly gone blind. She had within a short time been refracted by a very excellent ophthalmologist in a near-by city and on her return to an adjacent village was discovered to be so nearly blind in one eye that she refused to recognize the difference betewen the bright light in my dark room and absolute darkness, while with the other vision was reduced to

4/200. The most careful examination of the eyegrounds failed to give the slightest reason for her loss of sight; and in the eye which was said to be blind the pupillary reflexes were perfect. There was no doubt, however, that the child believed herself to be blind. For some time she had been led about by her parents and the case had been looked on by the surgeon who had been consulted as a most obscure one. The absence of any definite reason for her loss of sight assured me that it was her mind which was blind and not her eyes. I therefore referred her to my friend, Dr. Edwin A. Bowerman, whose wide experience in neurology warranted him in assuring me that no organic lesions were anywhere present. The treatment employed was wholly of a moral character. The child was assured that she was not *blind*; that she would very soon be able to see again. The eye in which a little sight remained was bandaged, and she was sent into another room and told that she would within a very short time be able to guide herself. Within half an hour, she was avoiding chairs and could distinguish the fenders in the fireplace; and within three weeks her vision with glasses, which had been prescribed for her, had risen gradually to normal in one eye, and to 20/40 in the other in which was found a permanent amblyopia. The origin of the hysteria was exceedingly interesting. The child was highly hyperopic, one eye being also amblyopic, and her attention had not been called to this until it was brought to her notice by the refractive test. On returning home she realized, partly by reason of the stronger glasses, and partly by reason of the fact that the amblyopia had been brought to her notice, that she was not seeing clearly. She said to her father, an excitable and neurotic Methodist minister, "I can't see." The father, growing obviously nervous and excited, remarked to the mother, before the child, "Nellie is going blind." The mother equally excitable, agreed with this conclusion; and, Nellie, of the same neurotic strain, immediately proceeded to go blind. As it was a suggestion which led her to lose her sight it was equally possible by means of suggestion to restore it.

At about this same time another girl, of about the same age, having similar extreme symptoms, was also led into my office; this time a case of interstitial keratitis, which required three months of energetic treatment before it was cured. One cannot but realize that had both of these cases fallen into the hands of Christian scientists or mental therapeutists, the one would have been heralded as a most marvelous cure, being within the range and suitable for mental treatment; the other child would have become blind.

PSYCHIC BLINDNESS

Case 2.—Some time after that another young girl, this one about 15 years old, was sent by her employer to me because of her failure to recover, under the care of a colleague, from what seemed to be a very serious condition involving her sight. Her eyes had begun to trouble her several months before and she had received glasses of low refractive value. Three weeks before coming to me, the sight

in her right eye had rapidly decreased, until on July 30, 1913, when she was found to have for the right eye vision of but 3 feet for fingers, the left was 6/8, and as in the former case no lesion of any character whatever could be found in the eye grounds. The pupilliary reactions were normal, although the pupils were somewhat large. She was quite without symptoms excepts the unexplainable loss of sight. Her nose and pharynx were in good condition, but she had had severe hemorrhages from the nose in the early spring which continued for the greater portion of a week, sometimes occurring three times daily, and from which she had lost a large amount of blood. There was a small black pigment patch near the macula of the right eye, but otherwise the eyegrounds seemed to be in perfectly normal condition. She had lost her father rather suddenly three months before, and had been depressed in consequence. The family were in greatly reduced circumstances and were largely dependent on the efforts of this child for their support. She evidently was suffering from a purely psychic depression. The loss of her father and the unexpected burden thrown on her untrained shoulders, and probably, largely the fact of a lack of sympathy on the part of her fellow workers, was more than this frail sensitive child could endure. She was reassured and made to understand that her employer was interested in her welfare and that she would rapidly recover her sight, which she immediately proceeded to do.

HYSTERICAL BLEPHAROSPASM AND PHOTOPHOBIA

Sept. 3, 1912, a girl of 20 years was brought to my office by her father from a small town in Pennsylvania. Her head was enveloped in a multitude of black wraps, and it was with the greatest difficulty that I was able to get her to allow me to see her eyes in order that they might be examined. She had been troubled with her eyes for six years and for four years had suffered so much from photophobia and involuntary spasms of the orbicularis that she was not able to bear the least amount of either natural or artificial light. Unfortunately, she had been very badly advised, frequently being kept in a dark room by her physicians for weeks at a time, and always directed to protect her eyes from the daylight when she ventured into the bright light. With great difficulty, I finally succeeded in allowing her to permit an examination of her eyes, but found absolutely nothing of an abnormal character. There was no inflammation either of the lids or of the eyeballs, and no evidence of any disturbance in the fundus. With great difficulty, I succeeded in determining the refraction and found only a small amount of astigmatism with normal vision in each eye. She had a sensation of tension and swelling in the forehead, a numb feeling in the legs when she read and she could not bear to look on bright-colored or striped cloth. She complained of intense pain in the back of the neck when she made any physical effort, had much aching in the back, and had, on the advice of her physician, used iodin on the neck and fly blisters on her back. In order to be reassured as to the physical condition, she was referred to my friend, Dr. R. M. Schley, of wide neurological experience, who after a careful examination

found the only physical defect to be a floating kidney. This was corrected by a suitable support. She was given glasses for the moderate astigmatism and was definitely made to realize that her eyes were in no danger and could and should be used. Her confidence was reestablished, the bandages were taken from her eyes and she was made gradually to accustom herself to the light. Within three weeks she was bearing ordinary light without discomfort, and within two months was able to use her eyes with perfect freedom. She had lived in a little town, had become extremely self-centered, had a slight irritation in her eyes which she was led to believe was serious and had had this misapprehension sustained by bad advice during four of the most important years of her life, which were absolutely lost to her.

ARTIFICIAL HYSTERICAL ULCER

Some years ago I found in my clinic of the Charity Eye, Ear, Nose and Throat Hospital a young girl who had an angry abraided ulcer on the skin in the corner of her left eye. She had been attending the clinic for several weeks and measures that had been employed for her relief seemed to be totally insufficient in curing it. Her general condition appeared to be quite good although she was a frail, and sensitive child of 16. There could be no apparent explanation for the development of such an evidently non-infective sore. It had all the appearance of being due to a local irritant, and no adequate explanation had been given. The girl was exceedingly quiet and seemed to be greatly depressed. Inquiry as to the conditions under which she was living was unsatisfactory, so I asked my friend, Dr. Schley, whose interest was not wholly neurological, but also in general social betterment, to visit the home of the child and find what the existing conditions were. This delicate girl was found to be living alone with an insane mother in an impoverished condition. She was afraid, and was as hungry for sympathy and moral support as for material nourishment. She at least met her human kind and had some attention paid to her on her visits to the out-department of the hospital, so she had deliberately made the sore and kept it up. Her mother was sent to the State Hospital, where she belonged, the girl put under right conditions and a problem of social importance was solved at the same time that the girl received the necessary assistance. In such morbid surroundings it is quite possible that the girl would have accompanied her mother to the hospital for the insane had not the right conditions been provided under which she might live.

OCULAR NEURALGIA SIMULATING GLAUCOMA

It is not only young women who suffer from such conditions as this. Last August, I was called in consultation to see a patient with a physician who had been treating him for glaucoma and failed to relieve the intense pain by repeated applications of eserin. I was called to make an iridectomy. The man, who was a railroad

employee, had gotten a cinder in the left eye which had been quite properly treated during the month of July of 1912, but in his own mind the importance of the condition had been greatly overestimated, and in this he was supported by a very nervous wife. In November he consulted another physician through whom he ultimately came under my observation. He seems to have suffered intense pain in his eye from November of 1912 until February, 1913. In May, he had a slight attack of pseudoparalysis of the right side. He had been wearing myopic cylinders for a hyperopic astigmatism differing in degree and angle in both eyes; the visual fields were invested. The eyeground showed no change and vision in each eye was normal. He was simply panic stricken and assumed that he was going blind. There was some increased arterial tension, but he was suffering from hysterical panic. In order than any actual lesions might be eliminated in an understanding of his condition he was referred to my friend, Dr. E. A. Sharp, whose report is appended.

Case 3.—Aug. 7, 1913. G. G. Cinder in left eye, July 10, 1912 Took morphin on account of pain, up to two months ago. May, 1913, had a sudden paralysis of right side. Fell unconscious while going to bathroom. Right hemiplegia. Arm and leg paralyzed. Tongue thick and difficulty in speaking. After four or five days speech became normal. In three or four weeks he could walk with use of a cane. Gradual improvement since. Right foot gets tired and numb easily. Pains of shooting character occur at times in right leg.

Physical Condition.—Large heavy adult; complexion clear; no deformities of skull or vertebral column; heart and lungs normal.

Mental Condition.—The patient says his memory is not as good as formerly. Since the accident to the eye in July, 1912, he has been unable to work. He worries about his position. Has general neurasthenic symptoms and is easily fatigued.

Cranial Nerves.—Disks not perfectly clear, but no swelling observed. Narrowing of visual fields (tested for form only). Ocular movements good in all directions. No nystagmus. Roving, restless movements of the eyes. Complains of diplopia when looking to right or left. No strabismus detected. Has single vision when both eyes are open, but says he sees double when one eye is closed. (Hysterical monocular diplopia.) On suggestion the separation of the two images can be regulated.

Motor Functions.—Right hemiparesis. All movements of right upper and lower extremities are performed with much less power than on left. No incoordination nor ataxia. No associated movements. No adiadokocinesia. No tremors in outstretched hands. Range of movements, equal right and left. No rigidity. Muscle tone good and equal right and left. No atrophy nor hypertrophy. Weakness of voluntary movements on right appear to be due to

lack of mental effort with inhibition and not to actual motor loss. Gait slightly shuffling and some scraping of right foot, but no spastic nor ataxic character. No Romberg symptom.

Sensory Functions.—Pains in stomach and bowels at times. Sometimes he has severe headaches and complains of numbness in right foot, but there is no loss to be demonstrated objectively. Joint and muscle sense normal.

Reflexes.—Biceps, triceps, radial, abdominal, patellar and achilles reflexes present and equal right and left. Plantar flexion, right and left. No Babinski, Oppenheim, Schaefer, Chaddock, or any other reflex indicating organic lesion of the pyramidal tract.

The right hemiparesis appears to be of functional nature and not the result of a cerebral hemorrhage nor thrombosis, and this is in keeping with the ocular symptoms of narrowing of the visual fields and monocular diplopia.

When he insisted that he had pain in the eye he was told definitely that he had not and he was made to understand that the difficulty was largely imaginary and exaggerated by his own fear. He was made to use auto-suggestion and told to reassure himself that nothing was going to happen that would be disastrous to him. He had been suffering for nearly a year and needed only this reassurance to enable him to reestablish himself. His physician thought he had glaucoma; had given him to understand that he had glaucoma and had told him the symptoms of glaucoma so that, in the event of an unexpected attack, he might immediately seek help; and had then given him eserin of nearly ten times the usual strength which had actually produced great pain; and so the patient had all the symptoms of glaucoma without any of the organic changes which accompany this condition. He got well when he was told to.

Many of these psychoses are primarily caused by a traumatism, as in the following case. The anamnesis was taken by my friend, Dr. A. E. Sharp, to whom I referred him. The following is his report. (I think that from the symptoms and result it may be definitely called a case of hysterical ptosis).

Case 4.—J. V., aged 8 years. July 26, 1913, while playing, fell in raspberry bush, was struck below right eye. Eye swollen; could not open it immediately following the accident. Has been unable to open the eye until today. (Aug. 9, 1913).

Present Condition.—Ptosis of right eyelid. Lid can be raised by frontalis sufficient to see when shield is placed over left eye.

Paralysis of right sixth nerve. No movement outward of right eye. Movements inward normal. Marked weakness of movements upward and downward of right eye.

Pupils unequal, right larger than left. React to light directly and consensually. No reaction in right pupil on effort to focus on near object nor on convergence. Left pupil reacts to convergence. Right internal strabismus. Diplopia. No nystagmus. Fundus and field normal. No disturbance of fifth nerve. No weakness of upper or lower face on voluntary movements, under effort, but in ordinary conversation the right face moves less than the left.

Suborbital reflex present, equal right and left. Hearing acute. Other cranial nerves normal. Sensory functions normal. No objective loss over any segment. Power and range of movements good and equal right and left. No incoördination nor ataxia. No tremors. Muscle tone normal. Reflexes of upper and lower extremities present and symmetrical. Normal.

A brother of the patient who accompanied him did not observe the onset of the trouble and the history regarding a febrile disturbance, etc., at the time of onset two weeks ago could not be obtained. The patient admits having had headaches at onset, but states that he was perfectly well prior to the fall in the berry bush.

The paralysis of the ocular muscles resembles that which occurs occasionally in poliomyelitis, although there is no history of other symptoms of poliomyelitis obtainable.

The case appears to me to have some organic disturbance, possibly of vascular or toxic origin. There is considerable functional disturbance also, but I hesitate to place it entirely in that category.

Psychosis may have an actual physical origin. The following is a most interesting case in point.

AGARAPHOBIA WITH ASTHENOPIA DUE TO NASAL OBSTRUCTION

A patient of mine whom I had not seen for a year, a man of 38 years, returned to be re-refracted, as he was unable to use his eyes with comfort. An inquiry into his condition developed the fact that for a number of months he had been a nervous wreck; had been obliged temporarily to resign an important business position and was planning to take an extended vacation in the South. He had suffered for years from agaraphobia; he had a sense of terror whenever he entered a crowded room or any place where there were a number of people. He could not bring himself to take a railroad journey. On one occasion he had gone to the depot, looked in and saw the crowds of people and ignominously turned around and went home again. He simply could not go in. He would occasionally waken in the night with this sense of terror and unless it could be controlled his business future would necessarily be destroyed. An examination of his eyes developed nothing new. Refractive errors had been fully corrected and there were no conditions that would account for the trouble from which he was suffering. He mentioned, incidentally, that he never got quite enough air through his nose, especially when he lay down at night. There was not enough obstruction to prevent his breathing, but there always was the feeling as though the amount of air was restricted. An examination of his nose showed enlarged middle turbinals narrowing the air space; these were removed with the effect that the insomnia, from which he had been a constant sufferer, was almost at once relieved. Gradually,

with the restoration of confidence, the fear of crowds disappeared. He was able to resume his business and go when and where he pleased.

The analysis of the case is the most interesting feature connected with it. There was not obstruction enough to seriously interfere with his breathing. There was enough, however, to so limit the amount of oxygen received that after several hours of sleep there would be a slight sense of suffocation. Any of us who have suffered from a sudden lack of a sufficiency of air, of a feeling that we are going to be suffocated, will understand the sense of terror to which this gives rise. It is much the same feeling that one experiences on being suddenly plunged under water. It is not that the deprivation of the air has been enough to seriously affect the respiration, but that the mental feeling that one cannot breathe, gives rise to this sense of sudden terror. When this fear occurs during sleep it so affects the subconscious mind that even after awakening the sensation persists, although the cause may have disappeared. A crowded room or a crowded car is associated with a vitiated atmosphere. As soon as this patient entered such a room, unconscious though it may have been, the realization of the limitation of oxygen, the subconscious mind responded with the sense of terror that he had experienced in his sleep until the habit was established and he associated the sense of fear with a crowd. The essential basis of his cure was that he must be made organically able to get an adequate supply of oxygen at all times.

The cases reported are typical of a large number that occur with greater or less frequency in the practice of all physicians. The observations of abnormalities of the eye in hysteria is not of recent date. In 1680 Charles Lepois described with considerable exactitude hysteric amaurosis. In his case were present cutaneous anesthesia, deafness and blindness. Probably because of the susceptibility of the Latin people to nervous crises, the most exact studies as to the nature and manifestations of hysteria have always been made by the French. The most complete monograph perhaps written on this subject, is from the pen of Pensier on "The Eye in Hysteria," and while his work has never appeared in English I am largely indebted for the following facts to a translation made by myself some years since. In this case in which hysteria is suspected, it is first necessary to determine whether the eyes of the subject, aside from the hysteria, are in a normal or a pathologic condition; either may be present. In the normal eye there are no obvious outer signs which would indicate the presence of hysteria. Robbin has said that "even aside from the attack one is struck by the peculiar

appearance of the eye of the hysterical (but this is by no means always true). The lids, if not hyperesthetic, are widely opened and rapidly shut with a blinking motion; the globe moves aimlessly from side to side, the movements being incoordinate as are their ideas. These indications, however, are neither sufficiently definite nor constant to be characteristic of the neurosis." Indeed, I have rarely found any more of the marked symptoms of hysteria obtrusively present—they must all be sought for. In testing the visual field, it will almost always be found that there exists some unusual form for the field of colors. It will be noted that the range of field has been no longer maintained in the usual order of the white, blue, red and green. The red and blue closely approach the limits of white. The circles of white, red and blue have almost become tangents. Blue occasionally becomes the peripheric color. Not infrequently the colors do not maintain their respective relations, the field or red may be greater than that of blue, even the red may become peripheric. The green is most constant, but in very exceptional instances this may be found to be the larger field.

MODIFICATION OF THE SENSIBILITIES IN THE OCULAR REGION

Anesthesia of the palpebrae is of rare occurrence, disassociated with hemianesthesia. Charot and Frere have found in some instances hysteric insensibilities of the tegument may be limited to the skin of the orbit as well as involving the conjunctivae. I have myself found this to be true. A well-known feature in connection with anesthesia of the ocular membranes is the preservation of the glandular reflex. Notwithstanding the lack of sensation, excitation of the conjunctiva will produce an abundant flow of tears. The secretion is produced rather more slowly, however, than in the normal eye.

One of the most interesting and as yet unexplained features connected with hysteria, is the existence of the hysterogenic zones in the ocular region. There are those which may be associated with a spasmodic action and those which produce a lethargic condition. Pensier says that toward the close of a hysterical crisis if, without special purpose, we should blow on the eyes of a patient we may find immediately a hypnotic condition to supervene. We may repeat this maneuvre in each attack toward the close of the crisis, and each time with the same result in the same way. Compression of the ocular globes may produce an opposite result, and the hypnotic condition may become the spasmodic.

A case is cited by Ribalkin of a young girl in whom compression of the eye excited a lethargic condition of the opposite side of the body. In other cases convulsive attacks have been produced by

compression of the ocular globes. Lichtwitz, who made careful experiments, claimed to have located definitely certain spasmogenic points in the conjunctiva, cornea, and the lachrymal canal, while Charot demonstrated the existence of corresponding hysterogenic zones in the deeper ocular structures which may be excited by a more or less prolonged action of rays of light. One of the earliest prodromal symptoms is an appearance of or increase in the amblyopia. This is associated with a complete loss of vision for colors and diminution of the central acuity. Mydriasis, irresponsive to eserin, has also been described. Usually the pupil is perfectly responsive to light. Following an attack, temporary contraction of the ocular muscles has been observed. Monocular diplopia with spasm of the accommodation has also been recognized. Hallucinations of sight are not unusual. These sometimes take on the form of a ball of fire or the grotesque figures of the bodies of animals. In the hallucinations, unlike those in alcoholism, the figures are said to be luminous; they usually appear on the side of the hemianesthesia.

It is not necessary to go into a detailed consideration of the various symptoms which have been found in hysteria, but one is of very great importance and its early recognition may save great trouble. It is that in which there is great difficulty of using the eyes, notwithstanding the appearance of any corrigible conditions which would be adequate to explain the discomfort suffered. It is a form of nervous asthenopia, described by Donders as painful accommodation. It is also known as hysterical ocular neuralgia. It is more frequently found in women. It is described by Abadie, who says: "There is no practitioner of experience who has not found among his feminine clientele those who are unable to use their eyes for a moment without experiencing violent pains in the head and most severe photophobia, with aching in the frontal and peri-orbital regions. There will also be burning of the lids and a sensation as if there were dust in the eyes. Usually no refractive anomaly is present, nor is there any abnormality of the fundus to be discovered. The women in whom the conditions are most likely to be found, according to Nuel, are unmarried women who are no longer young, or married women who are sterile." Hysterical ophthalmic migraine sometimes accompanies or precedes an attack which may be produced by the compression of certain points termed migrainogenetic zones. Hemianopsia has never been found with this form of migraine. Hysterical involvements of the muscles of the eye is both interesting and peculiar. Nystagmus is rarely seen. Blepharospasm is not infrequent and may be either clonic, tonic or pseudoparalytic. Wilbrand and Saenger devote many pages in

their monumental work to the consideration of forms of hysterical ptosis, usually produced by some slight injury.

The whole subject is invested with great interest, as it necessitates a refinement of diagnosis in separating the imaginary from the pathologic, in enabling one to understand and to explain the difficulty sometimes met with in securing responses when disturbing symptoms persist, notwithstanding the fact that normal conditions have been restored and in applying, where necessary, psychic therapeutics and thereby obtaining results which cannot be secured through other means.

DISCUSSION

DR. S. D. RISLEY, Philadelphia: I am personally indebted to Dr. Lewis for his very interesting and suggestive paper. Perplexing psychic problems often present themselves for study and management. I have not always found it easy to differentiate the psychic phenomena from the symptom-complex presented by the malingerer. As an illustration of the latter I recall the case of a small Irish lad, brought to the clinic by his mother, who feigned total blindness in one eye resulting from a stroke by a carter's whip. No injury was demonstrable and it was not difficult to prove good binocular vision and a little well-directed inquiry proved that the boy preferred his play in the streets to the confinement of the schoolroom. When the mother was told that she had been deceived, anxiety gave place to anger, and taking him by the collar of his coat she shook him until his teeth chattered.

The purely psychic type of blindness present a more difficult problem. By way of illustration I recall the case of a woman led to the clinic by her husband and brother in a perfectly helpless condition. Her eyes had been good until the previous evening, when she had fallen asleep, tired from her day's work in the mill, while sitting on her doorstep in the bright moonlight. When roused by her husband she awoke totally blind, obviously a victim of an old superstition, rife among people of her class. She entered the clinic room with head erect, but unseeing, as one totally blind from optic atrophy. The demeanor of the patient was quite different from that of the malingerer. She was anxious indeed, obviously alarmed and distraught over her misfortune. It was an example of psychic blindness. There was no question in her own mind as to the fact of her loss of vision, a mental state which had been enhanced by the genuine alarm of her male companions who had led her to the clinic.

Careful study discovered no cause for blindness. Realizing that some profound impression must be made to break up her mental state, she was seated in an arm-chair facing a broad window through which the hot afternoon sun was shining, a speculum placed in each eye and her head held firmly. For a full minute or more she bore the sunlight without flinching and in apparent unconsciousness of the light. Then suddenly things happened! She sprang violently from the chair, demanded that the "eye gags" be removed and left the clinic room without aid, in a rage and with a flood of profane language suggesting the ultraviolet end of the spectrum and followed by her dazed male attendants, who doubtless wondered by what miraculous power her vision had been restored.

I have seen many examples of the hysterical type of blindness. One of these had been under the care of her physician for three months, during which time she had lost, first the vision in the right eye and finally in the left also. She came with a long letter giving the history of her trouble

and the treatment which had been followed. Certain incongruities suggested a psychic element. Having this suspicion in mind, she was ushered into the consulting-room and, left without her accustomed guidance, replied with a cheery smile to a cheerful greeting and without difficulty met the proffered hand, evidently forgetful of her lost vision. When asked to look at the letter chart she could not see even light. After careful study, a boracic-acid wash was instilled and the statement made that "it had not been known to fail in expected results from its use," that she would be called in again in half an hour from the waiting-room, when she would be able to see at least half of the letters on the chart. This she did, and was told that a second instillation would restore her vision, and after a second half hour in the waiting room she had V.=6/vi in each eye. She was then told frankly of the psychic nature of the trouble and of the serious influence over her hopes for a happy future and urged to adopt a life of unselfish usefulness.

Another and very interesting phase of psychic disturbance is constituted by the cases which sink from a state of invalidism into that of hypochondriasis which persists after the original condition has disappeared. This was illustrated by a dramatic example, which began at 17 years of age with impairment of the general health and corneal disease, and after seventeen years in a dark room, was still the victim of a causeless photophobia.

Inspection showed no ocular disease, but the corneal maculae and nebulous areas were the remaining evidence of her former affliction. The psychic fear of light was broken through by a dominant control of her habits and the woman restored to a normal life which has continued up to the present time—twenty years.

Dr. John Green, Jr., St. Louis: There are some individuals hardly to be included in the category of hysterics or neurasthenics, who, because of long-continued asthenopia, due to uncorrected ametropia, have become obsessed with the idea that they cannot use their eyes at all. The most careful correction of the refraction will not enable these individuals immediately to use their eyes, as the obsession remains after the glasses are prescribed. In such cases, I believe, it is well to gain the cooperation of the patient and interest him in his own case.

I insist that, disregarding pain or other discomfort, he shall begin to use his eyes a certain amount daily, possibly in the beginning not more than five minutes—and shall increase a stated amount each day. The exercise is, if possible, divided into three periods: morning, afternoon and night, and the patient told to begin a written report, tabulated as above, with comments on his sensations and experiences. In this way he realizes shortly that visual ability is increasing and thus encouraged, the obsession of disability rapidly disappears.

Dr. John A. Donovan, Butte, Mont.: The following case was seen in consultation a few weeks ago, with a history of cerebral injury and, after a careful examination, I refused to make a diagnosis until I could get some outside history. Seeing a party interested in the litigation, I learned that a year previously, the same man had been pulling a rope fastened to a wire over another live wire. The man on the pole called out, "Look out; don't catch that wire." Though yet several feet from the wire, he fell unconscious and remained so for half an hour and was not able to work for days. Though he has many mental symptoms and derangement of special senses, there are no apparent signs of physical injury.

The point is that we are generally letting these people get away from us by way of Christian Science, Spiritualists and similar cults, whose

absurd teachings are gulped at, but often contain some truths applicable to these individuals. The thing to do is to have them get control of the psychic self. People like this are those who give way to anger. Under this heading are many subclassifications—irritation, ill temper, peevishness revenge, indignation, etc. Another almost equally dangerous class are the subjects of fear. Under this are anxiety, despondency, worry, etc. Jealousy is a combination of both. Any manifestation in the child of these conditions in an excessive degree should always receive immediate attention. Our psychical patients will all show some of these qualities in an abnormal degree. The treatment of such patients necessitates the long, patient, untiring efforts to undo what years of faulty development has made the individual.

DR. LEWIS (closing): I believe that even in those cases in which there is a definite shamming, the physic element enters to a degree. The subject, often in his endeavor to deceive others, deceives himself, and the exact degree to which actual and imagined conditions enter often require great skill in their determination. Their importance will be recognized in each phase of all diagnostic and therapeutic work.

THE BEST TIME TO PREPARE FOR SPECIAL PRACTICE

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In the circular letter sent a few months ago to prominent ophthalmologists, to inquire how they had prepared themselves for ophthalmic practice, three questions were included to bring out the time in their professional lives at which their attention had been turned to ophthalmology:

1. Did you feel any interest in ophthalmology before you graduated in medicine? If not, how long after graduation did you begin to look to it as a specialty to practice?

2. How long was it after entering on private practice before half or more of your professional income was drawn from your special practice?

3. How long after entering on private practice did you begin to confine your practice to your specialty or specialties?

About 250 of those addressed replied to most, or all, of these inquiries. A summary of these replies shows that 141, 55 per cent., became especially interested in ophthalmology before they graduated in medicine; and forty-two, or 16 per cent., the first year after graduation, most of these during a service as hospital intern, which might be regarded as a part of their course of medical study. Before the end of five years from graduation, 93 per cent. had definitely chosen ophthalmology as their line of professional work; and out of the whole number (257) but two had entered on it after ten years of practice.

To the second question only 246 responded, of whom eighty-eight, 36 per cent., had drawn more than half of their professional incomes from ophthalmic cases, from the beginning of their entrance on ophthalmic practice. Ninety-two, or 37 per cent. had half their income from their special work within the first five years, and only 27 per cent had attained this proportion after five years.

To the third question 249 responded, of whom eighty-one, almost 33 per cent., had confined their practice to special work from the very beginning; eighty-six, or 34 per cent., had confined it to this field within the first five years of practice, and eighty-two, or 33 per cent., had not restricted themselves entirely to the special work until they had been in practice more than five years. Only twenty

had done anything outside of their specialty for ten years after graduation.

The men to whom the letters were sent included nearly all the most prominent ophthalmologists in this country, a few not having responded. Without exception they were men regarded as the successful specialists in their localities, and most of them have made valuable contributions to the literature of their specialty.

These figures were to me somewhat surprising. When most of these men took up special work, there was but one orthodox way to enter a specialty. That was to take the course in general medical training, including, if possible, at least a year of clinical work after graduation, then to enter on general practice for a period of at least five or ten years before choosing or devoting one's efforts to any special line of work. The dogmatic confidence with which this rule of conduct was laid down for the guidance of the young physician and surgeon by men who knew nothing of the specialties and nothing of pedagogy, has constituted as striking an exposition of empirical dogmatism as I have ever witnessed.

It was so frequently repeated, so universally accepted, that it had such an influence on me, and on others with whom I have been closely associated, that I was surprised to find that this influence had not been more general. It came as something of a shock that men for whose professional attainments and standing I had come to have the highest respect, had never been in general practice at all, and had devoted a large part of their undergraduate study to ophthalmology, or had even entered on the study of medicine with that specialty clearly in view.

Looking back, it is easy to see that the dogma regarding general practice before specialization in medicine arose from the experience of men who started from the absurdly inadequate American medical teaching of the middle of the nineteenth century, and learned almost all they knew from their own experience. Unable to conceive of any other method of learning medicine they supposed that in condemning what they called "premature specialism" they were condemning a pretense at knowledge that had not been gained. They were largely ignorant of the recently developed science and art of modern ophthalmology, and completely ignorant of the opportunities for studying it then offered in the great medical centers of Europe. Such a leader of the profession, the professor of surgery in one of the great Philadelphia medical schools, when Ezra Dyer came back from Europe after two and one-half years of study with von Arlt, Graefe, Desmarres, Sichel, Donders, Snellen, Bowman and the elder Critchett, poured ridicule on Dyer's intention to practice oph-

thalmology exclusively; and explained that he, himself, taught the whole subject of diseases of the eye in two lectures of his course on surgery.

In view of this general disposition on the part of the profession to frown on the early adoption of a specialty, it would be quite strange if so large a proportion of those taking up special practice had done so in the defiance of the general professional opinion. These statistics do not fairly represent the course pursued by the mass of men who have sought to confine their work to ophthalmic practice. I have no general statistics to offer with regard to those who have failed in special practice. Such statistics would be difficult to obtain. But among my personal acquaintance I can count six fairly steady, industrious, responsible, intelligent practitioners, who have tried to work into ophthalmic practice, but whose efforts have finally ended in conspicuous failure. All have taken up ophthalmology after three years out of the medical school, and all but one after five years of general practice.

In strong contrast with this has been the course generally pursued by a series of those whose professional careers we may regard as more than ordinarily successful. I have studied together the reports of all still living who have served as Presidents of this Academy, or of the American Ophthalmological Society, or as chairman of the Section of Ophthalmology of the American Medical Association. These number twenty-five, of whom fifteen, 60 per cent., became interested in ophthalmology before their graduation in medicine. All of them have developed such an interest within three years after graduation. Thirty per cent. of them never did any general practice outside of a hospital. All but one were drawing the greater part of their professional income from ophthalmic practice at the end of five years. All but five confined their practice to ophthalmology at the end of five years, and all of them at the end of seven years from graduation.

The Transactions of the American Ophthalmological Society contain certain biographical sketches of its deceased former Presidents, and some of its more eminent members. With these printed biographies we can deal more freely and mention both names and facts. Details are often lacking; but one cannot consider the imperfect life histories of these leading American ophthalmologists without being impressed with the idea that their success as leaders in ophthalmology was in some way connected with their disregard of the prejudice against early specialism.

The first President of the Society was Edward Delafield of New York, who graduated in medicine in 1815. After an internship in

the New York Hospital he went to London for further study, and returned in 1820 to establish at once, in conjunction with Dr. John K. Rodgers, the New York Eye and Ear Infirmary. The second President of the Society was Henry W. Williams of Boston, who already well trained in mathematic optics, graduated in medicine in 1849. In 1850 he had organized and was instructing a class in diseases of the eye in the Harvard Medical School, and twelve years later he was the author of the leading American text-book on diseases of the eye. It is needless to say that Dr. Williams did not learn ophthalmology by the general practice of medicine. He numbered among the teachers of his early years Sichel, Desmarres, the elder Jaeger, Rosas, Dalrymple, Lawrence, Dixon, Critchett and Bowman. His successor was Dr. C. R. Agnew. Within two years after graduation Agnew was offered the position of surgeon in the New York Eye and Ear Infirmary, and accepted it with the stipulation that he should be allowed a year's leave of absence for study abroad. He was succeeded by Henry D. Noyes, who after graduation in 1855, spent three years in the New York Hospital, and after a year of study abroad returned in 1859 to take up special practice, and was that year elected assistant ophthalmic surgeon in the New York Eye and Ear Infirmary. After Noyes came Norris, who received his degree in medicine in 1861, and after his eighteen months in the Pennsylvania Hospital and two and one-half years in the medical service of the United States Army, spent five years in study abroad, under von Arlt, Jaeger, Mauthner and Stricker. He returned to Philadelphia in 1870 to be appointed lecturer of ophthalmology in the University of Pennsylvania.

Among other deceased presidents of the American Ophthalmological Society, George C. Harlan served as resident of Wills Eye Hospital before he graduated in medicine. Wadsworth, who graduated in 1865, after a few months in the Army went to Zurich to work under Horner, and when five years out of college was ophthalmic surgeon to the outpatient department of the Boston City Hospital. Charles Stedman Bull graduated in 1868, and after two years as intern in Bellevue Hospital, studied in Germany and France, returning in 1871, in which year he joined the American Ophthalmological Society and took up work in the Manhattan Eye and Ear Hospital and the New York Eye and Ear Infirmary. Charles J. Kipp graduated in 1861, and was five years in the United States Army. He had taken up the practice of ophthalmology in 1869, and shortly after organized an eye and ear clinic in St. Michael's Hospital. S. B. St. John graduated in 1870, served as intern in Bellevue Hospital, and in 1872 went to Europe for two

years of study. Six years after graduation he was an assistant surgeon in the New York Eye and Ear Infirmary.

These are all the deceased former Presidents of the American Ophthalmological Society. Among its eminent members we find Althoff, who graduated in medicine in 1858, then going to Germany to study. Four years after his graduation he was elected curator and microscopist in the New York Eye and Ear Infirmary. Ezra Dyer has been alluded to. Loring, taking the M. D. in 1864, published in the *Boston Medical and Surgical Journal*, December 1 of that year, a "Report of Operations in the Department of Ophthalmic Surgery at the Boston City Hospital," and within two years he had entered into partnership with C. R. Agnew in New York; and received appointments for ophthalmic services to one Brooklyn and two New York hospitals. E. Williams of Cincinnati, when four years out of college had demonstrated the use of the ophthalmoscope at Moorfield's Ophthalmic Hospital, and came back after two and one-half years of study under Graefe, Arlt, Desmarres, and Sichel to limit his practice to ophthalmology. D. B. St. John Roosa's general practice was limited to a term as house surgeon to the New York Hospital and one year of military service. Finally we have the life of Dr. Herman Knapp. His interest became centered in ophthalmology during his student days when Helmholtz described his invention of the ophthalmoscope. He had studied at Munich, Würzburg, Berlin, Leipsic and Zurich before taking his medical degree at Giessen in 1854. He extended the field of his studies to Berlin with Graefe, to London, with Bowman and Critchett, to Utrecht, with Donders, to Paris, with Desmarres and in the Sorbonne, and in 1859 had qualified as a teacher of ophthalmology at Heidelberg, by his paper on the "Optical Constants of the Eye."

But some one will remind us of the importance of breadth of culture. It is worth while to speak of this. No one ever attains breadth of culture who does not possess broad interests, that he continues to feed and cultivate throughout life. It is not secured by multiple or diffused separate interests in youth followed by a narrowing of interests later. It depends rather on the force of one's chief interest, and its sufficiency to carry him beyond custom and routine to seek satisfaction in the relations of more distant facts. The idea that one can first obtain broad culture and then concentrate on a narrow specialty is fallacious.

Breadth of view, catholicity of interests, sympathy with all sorts of men, depend rather on the width of the field over which one's original central interest will carry him to search for related facts. It depends rather on the intensity of the central interest and

the habit of looking abroad and bringing matter home to it and not on a multiplicity of interests that have never been correlated into an individual life. Breadth of culture will depend more on one's original cast of mind and the methods and inspiration he catches from early teachers, than on studying many things for a few years in disconnected fashion. The student who becomes so interested in ophthalmology that he arranges his knowledge of the whole of medical science in relation to ophthalmology is more likely to be the one to push out into still broader fields to be brought into relation with his central interests, than the one whose interest is so lukewarm that it permits him to neglect it for other things, or is acquired so late it can never fill more than a minor portion of his life. It needs to be emphasized that interest in a specialty, even from early student days, need not be a hindrance and may greatly help toward a broad culture. To know everything about one subject is to know something about every subject.

But we do not study ophthalmology solely for breadth of culture. We study it to perform a function toward our fellow men. The success of our cultivation of this special field is measured by the assistance it enables us to give to those who need our assistance. By the facility and skill we attain in the application of our art is our success to be justified. As to this aspect of our work the arguments for the early selection of a specialty are overwhelming. The knowledge of ophthalmology to be attained, the skill in its application to be mastered, are infinite. So far from teaching it all in two lectures, none of us will learn it all in a lifetime. We will not approach its limits, for it has no limits. Every year that our ophthalmic life is shortened, will by so much diminish professional achievement. Every interest which diverts our effort from it into unrelated channels, will by so much diminish the effective results that we shall achieve. No one gets anywhere by starting in one direction, and then going back and starting in another direction. He travels farthest who selects the direction he wants to go, and moves persistently in that direction.

It is not simply that there are many facts to learn in ophthalmology. There is skill to be acquired, of which it is very difficult to attain to the highest degree. Take the mere mechanics of our art. It is said that it takes three generations to make a glass-blower. It takes two generations to make a safe and reliable miner. No famous musician ever began his serious pursuit of music after the age of adolescence. Do we suppose one will develop the highest skill in cataract extraction who becomes interested in such manipulations after the age of 30? Has not the community as much right

to demand skill of the cataract operator as of the musician, or miner, or glass-blower? Perhaps the greatest lesson proceeding from the life of Graefe, the son of a famous oculist, who studied medicine that he might practice ophthalmology, is yet to be fully appreciated by those who for a generation have held him in the highest regard.

Of course, much of the skill that is to be applied in ophthalmic practice can be acquired by doing things in other fields. The exact mechanical operations of a cataract extraction will be best done by one who has been trained to exact manipulations in childhood or adolescence. Perhaps the best training for this particular purpose is mechanical drawing. Some one expressed admiration for the use a British ophthalmologist made of his fingers in operating. "Oh, you should see him with the 'cello," was the reply. Minute accuracy of judgment as to color, which is of high importance in recognizing phases of ocular inflammation, may well be cultivated by color sketching. The accurate physical measurements required to correct errors of refraction will come more naturally and easily, and will be performed more perfectly by one who has had good training in the exact measurements of a physical laboratory. The mathematical training needed for a mastery of physiologic optics belongs in the premedical education.

In the majority of cases an important part of preparation for ophthalmic practice must take place before the special line of professional work is decided on. The skill acquired in a particular direction may well be an important factor in determining the selection. But this does not require that the choosing of a specialty should be consciously deferred, or that the varied training which is to count in the final result will be any less effective because from the first it has been consciously directed toward its true end.

The recorded experience of successful ophthalmologists agrees with the longer experience of the race; that youth is the period peculiarly suited to the development of aptitudes, and the acquirement of knowledge and skill; that from its beginning the plasticity of mind and body continuously decrease. The process of special education must go on throughout life. But the sooner it begins the better will be the result.

We need not imitate the old dogmatism from which some of us have suffered; and rather urge that a doctor who has been five years out of college should never attempt to study a specialty. Among our honored colleagues are a very few whose attention had not been turned in that direction until after that period, and a few who with the purpose conceived in student days, had been unable to carry it

out until after five or even ten years in general practice. Continuing as students in the broad truest sense, they were able to make good in spite of the delay and distraction. But it ought to be generally recognized that the most direct and certain path toward success in a specialty is this:

The premedical studies should include such branches as will be most generally and directly applicable in the later studies—for ophthalmology, physics, mathematics, mechanical drawing, work with colors, in addition to the biological studies and laboratory technic that count in all branches of medicine. After this, the general medical course, which should be remodeled to meet the requirements of subsequent specialization in practice in all directions, and completed by a year of work in a teaching hospital.

Then the special study of ophthalmology should begin through a formal course of instruction, or as intern to an ophthalmic hospital, assistant to a teacher of ophthalmology, or by daily work in an ophthalmic clinic for at least one year. It will be better if the time wholly devoted to such preparation be extended to two years, and the lines along which it is pursued varied. For instance, after a year of systematic study and clinical work, another year or more may be profitably spent as office assistant to an ophthalmologist After a year as intern in an ophthalmic hospital, the second year may be spent in taking a systematic course, or working in various ophthalmic clinics.

Professional success will only be attained when the interest and application of the student are continued for a period of five or more years, parallel to the developing of ophthalmic practice. But it should be made clear to all who intend to be specialists that there should be no break between undergraduate and special studies; that so soon as an interest in ophthalmology is aroused, and the purpose formed to take it up as a principal life work; that interest should be made dominant, and the purpose carried into effect as immediately and directly as possible.

DISCUSSION

DR. WALTER B. LANCASTER, Boston: After such a masterly address on this subject, it is clear that there is nothing to be added. Not only has the subject been covered fully but I believe convincingly, and I feel sure that those who are likely to oppose this movement will be overwhelmed.

There is this to be said about educational matters. To lay out a course of study is a matter for conservatism and it is in the hands of conservatives, which is proper. But we must remember that progress is absolutely impossible without change, and if conservatives will forever stick to the old courses and dogmas there will be no progress. I am confident that they will not carry their conservatism to that point. If we look back on the history of general knowledge and education, I think we may get some light on this subject. Not many years ago a man, to be a leader in any branch

of learning, must have been a leader in many branches and well versed in all. Dr. Thomas Young was an example of that sort of man. His skill and ability to do things were extraordinary, even to measuring to several places of decimals, the curvature of his own cornea by instruments applied directly to its surface. He could do anything and knew everything. But he was the last of whom that could be said. Progress in human knowledge is such that there can never be any more man of that type—never be a man who knows everything that is known in all subjects.

In medicine, the number of things added year by year to what is known is so enormous that it is impossible for any one man to cover the whole field. We cannot expect even the best ophthalmologists to be masters not only in ophthalmology, but in all other branches of medicine as well. It must be divided. We must be willing to pass by many things well worth knowing in order to make it possible to choose the things which, for us, are even more worth knowing. While every one, of course, must have a broad general medical training requiring four years, and founded on a broad and generous education and training of all his faculties, the time will come to every man when he cannot pursue general topics further, except at a cost in neglecting his special field, and this he cannot afford. Thus I do not advocate, as some seem to do, pursuing his general medical training in the medical school and in practice up to a certain, or uncertain point and then abandoning general work, before taking up the study of his special field. But I advise him to begin his special studies during the fourth year of his medical school work and while continuing general work in school and in practice (hospital or private) for one or two years longer, I advise giving an increasing share of his attention to his specialty which, by the sixth year, may well be engrossing his chief attention. But never should the time come when he ceases to pursue his general studies, not ceasing altogether to read articles by the great leaders in all branches of medicine, physiology, pathology, psychology, surgery, clinical medicine and therapeutics, preventive medicine, etc.

Show me a man who has made a good golfer who began after he was 30, and I will show you one who might have made a wonder if he had begun before he was 10. The same is true of ophthalmology. If I had a boy worthy to be called to the high calling of the ophthalmologist, I should not have him begin to specialize as an undergraduate. No. He should begin in the nursery. He should be training his eyes and hands and all his faculties with that in view from the beginning. But even then the subject is too large for any one ever to expect to encompass its limits.

Dr. Wendell Reber, Philadelphia: I hesitate somewhat, Mr. President, to discuss any paper that is set forth by so eminent a man as Dr. Jackson, on a subject of such great weight as this—of the equipment of the ophthalmologist, especially as I must take issue with him on one point. While I thoroughly agree with everything he has said, and particularly with the sentiments set forth by Dr. Lancaster in "beginning the training of young men early," our science rests on such broad foundations that I do not think five years of the most thorough-going education in all the problems of medical science would be too much of an equipment for a young man who wishes to take up ophthalmology as his life work. When we consider that our science has practically three or four great departments within itself, we will realize how thorough should be the foundation. If Dr. Jackson would be good enough to tell us how we could crowd some more hours into the general medical curriculum, I should feel personally much obliged.

What is being done in the way of postgraduate teaching is also, I think, a matter for discussion here. I do not know whether a committee has

been formed from our Academy as from the American Ophthalmological Society, to confer on postgraduate instruction. If not, we certainly ought to form a committee with that function in view. For one thing is certain, that even as undergraduate medical education has been regulated, postgraduate will soon be regulated, and there will be a uniform standard for any one wishing to enter our ranks. As I said to you a year ago, our committee should strive to arrive at what it thinks should be the general medical training of any young man when he enters on the study of ophthalmology as a science, and then set down a standard uniform requirement for any one to be admitted to the practice of ophthalmology; for regulated it will be, I am sure, either by state or by national regulation.

Dr. J. M. Banister, Omaha, Neb.: In the minds of general surgeons and physicians it is held as an opprobrium of the ophthalmologist that he considers the eye as an organ almost independent of the rest of the body, and limits his attention to it alone, without considering its relations and dependence on the general body economy. In other words, he is considered, as a rule, by the body of the profession, as not being thoroughly *au fait* in the teachings of modern medicine and surgery, and from lack of practical experience in general medicine, as not being qualified to view ocular affections in their proper relations to general pathological states.

There may be some just reason for this feeling of prejudice on the part of the general profession, and I believe that this reason is furnished by some of the views expressed in this paper.

I am firmly convinced that a great mistake is made when we underestimate the value to ophthalmology of knowledge acquired at the bedside and at the operating-table. We will do ourselves individual harm, and cause the rest of the profession to look askance if we endorse such views.

I am opposed in theory and from experience to the view that one should enter the practice of ophthalmology without preliminary training and practice in medicine and surgery.

One possessed of the knowledge and experience so acquired will in his special work as an ophthalmologist, be a far deeper thinker, a far better diagnostician, a far better master of ocular therapeutics, and a far better ophthalmic surgeon, than he would be were he not so fortunate as to have acquired such general professional attainments.

We should broaden our professional horizon, not contract it, and relegate ophthalmology to a position a few degrees higher than that of the optician's trade.

Dr. S. D. Risley, Philadelphia: I wish to congratulate Dr. Jackson on the admirable paper he has presented. In the main I am quite in agreement with its teaching, but nevertheless feel that in preparation for a career in ophthalmology the trend or habit of mind in any individual should be considered; all men cannot or should not be measured by the same tapeline. I have been honored by the personal acquaintance or friendship in my early professional career with most of the galaxy of eminent men enumerated by Dr. Jackson. With one of them, Dr. William F. Norris, I have lived for many years in the intimate association of pupil, assistant and friend. Dr. Norris' preparation for his notable career in ophthalmology had been most fortuitous. The son of a great surgeon, after his graduation in medicine, he had passed an internship in the great Pennsylvania Hospital under the tutelage of its staff of eminent physicians and surgeons; and then during the Civil War, became an Army surgeon and often spoke of his experience on the field of conflict and in the great Army hospital at Washington. It was with this great experience as a background that he began his ophthalmological studies in Europe.

If I may be forgiven for a personal note, I can not be too thankful for the teachers and circumstances preceding my special work which had been pursued without any thoughtful relation to it. The work as a student, when a mere boy, under the inspiring influence of Gustavus Hinrichs, now a member of the French Academy, in the laboratory for qualitative and quantitative analysis; the work of geology, paleontology and mineralogy had all been of inestimable value; not so much for the facts acquired as for the habit of mind engendered by the work. Nor can I be unmindful of the valuable experience gained by three years' work as visiting physician for a great dispensary to the homes of the sick poor in a populous district of Philadelphia, where the facies of disease was learned. It all served as a helpful background for special ophthalmological work.

During the early years of specialization there was undoubtedly a tendency to drift away from our moorings to general medicine. But to those who are thoughful, there is now an obvious evolution toward closer relationship, a more definite recognition of the necessity of first being a wise physician and then an ophthalmologist.

Colonel Elliot, London, Eng.: I feel that our specialty takes us into relationship with so many other branches of medicine and surgery that we must know these before we can be first-class ophthalmologists. I feel, if we are going to start our men out as ophthalmologists sooner, we shall manufacture a number of excellent men, but at the same time a number of one-sided specialists. It attracted me from the time I was a student, but I was unable to give attention to it for fifteen years, but I never lost sight of it, except when I was assigned to the laboratory on an investigation on snake poison. A friend told me I was a fool to be sidetracked like that; but I have never regretted that work in Professor Shaffer's laboratory and the manipulative dexterity that it gave me, and I consider that time as far from being wasted.

In England, we hold that a young man, if he can afford the time, will make a better man if he can spend three or four years taking a good general education. The men of Oxford and Cambridge have a breadth of view which strikingly stands forth in these men. I would plead with you not to go too fast. I would make my young man do two solid years of general work and then I would set him on his work as an ophthalmologist. I do not believe he will lose by it, but will gain by it in the end.

Dr. Jackson asked if anyone knew an ophthalmologist who had gone into the work after the age of 30. The most expert man I ever knew with his fingers was Dr. T. H. Pope, and he told me he had never touched a cataract until he was 40. I do not urge that, but there is no question but that even a man who takes it up in later life can learn cataract extraction.

Dr. G. S. Savage, Nashville, Tenn.: I still believe that the most thorough medical preparation is necessary for the man who expects to practice ophthalmology. If I had a son who expected to follow me I would want him to acquire a college education before taking up the study of medicine, and then I would want him to take the entire medical course just as if he were intending to practice general medicine and surgery. After procuring his diploma, I would then wish him to have a year or more of hospital experience, in the general wards of some hospital, or I would want him to practice medicine for a few years. During the hospital service, or while engaged in the general practice, I would wish him to devote all spare time to the study of ophthalmology, and then I would wish him to have a year's training in some of the special hospitals of this country. After beginning the practice of ophthalmology, I would then desire that he should attend the meetings of his local medical society and of the state

medical association, that he might in that way keep in close touch with medicine in its broadest sense. At home I teach this by my example, and everywhere I try to teach it by precept.

DR. F. PARK LEWIS, Buffalo: There is another point of equal importance which has not been emphasized in this discussion. It is essential not only that the ophthalmologist should know something of general medicine, but the internist must be more fully advised concerning the essentials of ophthalmology. If we include such fundamental essentials in the preliminary training of the general practitioner, they will have a firm basis from which later to build the special knowledge of ophthalmology. Nor must we expect that the ophthalmologist when he begins his practice will be as competent as he should be after five years of active practice. It may not be unreasonable to expect that our recognition of fitness may consist in the giving of two degrees—one of an academic character, which would be evidence of the adequate didactic instruction, and another which would be equivalent to the Master's Degree and which would indicate that maturity of mind and soundness of judgment, with the acquired technical skill that can only come from a riper experience.

DR. ALLEN GREENWOOD, Boston: Dr. Lancaster said the training should be from the cradle up, and I should agree that a training in manual dexterity and accurate observation is essential from very early childhood in those showing an adaptability for such things.

Without doubt any practice of general medicine helps the ophthalmologist, particularly in his operative work, where he should be able to detect with fingers and eyes any change in the patient's physical condition during the convalescence. Old people are prone to develop some disease, and how much better if the ophthalmologist can take the blood-pressure, and has developed that intuitive sense that is acquired in general practice, so that he can see at a glance that things are not going right. I think that ability comes in a greater measure to the man who has had some experience in general medicine. I should want to see a young man, as Dr. Lancaster suggested, training his fingers in boyhood, his powers of observation in Nature study, and then have hospital and bedside practice for a year or two and then start in with his ophthalmology. At the time of taking his course in the medical school he should take up ophthalmology as his special elective, getting a thorough training in optics.

DR. G. F. KEIPER, Lafayette, Ind.: In all this discussion we had better get down to fundamentals. Are we preparing ourselves for a living or for a life? I hope that you get the distinction. The most useful man to a community, professional or otherwise, is the one who is prepared for a life. His preparation is both genuine and secured early. This applies to our own work. The earlier one is prepared for special practice without wasting time in general practice, the better it is for him or her.

A large percentage of the membership of this Academy was prepared for this line of work by their fathers who had preceded them by many years of special practice, going right into it from the day of their graduation in medicine without doing any general practice to speak of. I have in mind a boy who has chosen this specialty as his life's work and let me assure you he will be prepared for it from the grade work in school, through high school and through college with postgraduate work, wherever it seems best at that future time to send him, just as was his father by a father who preceded him in the practice of medicine.

DR. L. H. TAYLOR, Wilkes-Barre, Pa.: I thought I had something to say when Jackson read the paper, but it has been said more than once by others. Only in one point do I take exception. I fear that Dr. Jackson

in his admirable presentation of this subject, would bring our young men a little too soon to the selection of the specialty. In Pennsylvania we have recently passed a law which will require, after Jan. 1, 1914, that every one entering into the practice of medicine shall have his four years of preparation and one year in hospital practice before receiving a license. It seems to me that this hospital period will be the time for him to select his special work. I do not believe that in his premedical studies he should decide what shall be his special life work. But he should have this thorough general preparation, as has been so well said by others, and I do believe most thoroughly with Dr. Jackson, that he should very early decide what shall be his preference.

I count myself happy that I had the opportunity of being an intern in a hospital before graduation. There was so little known in our neighborhood about eye diseases that I determined I should know something about them, although not with the idea then that this should be my special work. And I count myself especially happy that after having graduated and having decided to remain in postgraduate work for a time, I was asked to be assistant by one of the best men in the profession, and one of the best practitioners in this special work of which we have spoken to-day. I had the opportunity of being in his office for some months after graduation and had my mind directed to this special work before I went out into general practice. I refer to Dr. Risley. I do believe one should, early in his general work, go into special work, and have it outlined before him; but not that he should decide before he enters the study of medicine at all, that he ought to be an ophthalmologist. He should have, first of all, the general work, and as much of it as he can get.

Dr. W. C. Tuckerman, Cleveland: I believe we all essentially agree with Dr. Jackson. The trouble with the whole discussion is that by inference we are putting into this paper something he did not intend, and that inference is, that by urging the adoption of a specialty early, or thinking of it, he intends you to begin from boyhood to narrow your views. Everybody knows that the education of every person, whether he is to be a blacksmith or a farmer or what not, must begin with the use of his eyes. Next he must learn to read. We do not start out to teach him to read as a future ophthalmologist or preacher. We simply teach him to read. The essential point that Dr. Jackson has brought out is that as soon as a person makes up his mind to go into one line, he shall begin to direct his education along that line, and the sooner this can intelligently be done, the better. This does not preclude general practice in the meantime. The idea is not to limit, but to bend their education toward the line chosen. If you train a young person exclusively for one line and he is not fitted for it by Nature, he makes a failure of it, and his lack of training in other directions makes for failure in any other line he may attempt. Again, if a person, before he goes into special practice of any sort, tries himself out in general practice, and then sees an aptitude for a special line, he can then take it up with a reasonable assurance of success. If he starts in the beginning to say he will take up a special line and finds himself unfitted, he will have to make a step backward.

Dr. Jackson (closing discussion): I appreciate the discussion, and can see there is really less difference in the point of view than appears on the surface. You will remember I advocated the full course of undergraduate work, and one year following, before the educational scheme enters into special channels. We are all, properly, ready to praise the bridge that has carried us over, and appreciate the peculiar advantages we have enjoyed; and we are even ready to believe that particular method

is a little better than any other method, by which some one else has arrived at the same place. But there is a change coming in education, such as has been noted in the world of science. It is no longer thought by educators, thoroughly alive to the movements of the day, that there is one particular course all men should follow as a preparation for life. The main thing is to find out what the boy is particularly interested in. He will then go at his study in a different way and later on get an entirely different result. The student who is interested in ophthalmology and pursues it with enthusiasm, is apt to push out into still broader fields; will be more apt to be broad in his general interests than one who has such lukewarm interest in his chosen branch that it never fills a great place in his life. The man interested in ophthalmology is just as capable as anyone of studying general medicine. Who has done most to awaken interest in auto-intoxication in this country, starting medical men on this line of observation? An ophthalmologist, de Schweintz. It is not a question of whether you have had one or two years of experience in general medicine, but rather whether you have developed broad interests, and kept up these interests by attending your general medical societies, as Dr. Savage has said, and reading general medical journals. This is what will determine whether you shall be broad or narrow in the practice of your specialty.

EYE-STRAIN FROM FAULTY ILLUMINATION

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Problems of illumination involve a consideration of three factors: hygiene, aesthetics and economy. I mention these in their order of importance and so place hygiene first. Much work has been done and is being done by engineers, manufacturers and inventors, but for obvious reasons they have reversed the order and have made economy their first aim—the production of more and cheaper light. Only lately have they given attention to beauty and artistic effects in lighting, as distinguished from beauty and artistic effects in fixtures. Still less attention have they paid to hygiene, and I regret to say that they are little to blame, for they have appealed in vain to us for an accurate, complete and systematic treatment of this part of the problem.

While I have tried to make what I have written accurate, I am not foolish enough to think I have avoided all errors, and in view of the importance of the subject and the need of reliable information I beg of you to let no erroneous or doubtful statements pass unchallenged.

At the seventeenth International Congress of Medicine, held two months ago in London, one of the few topics set for discussion before the ophthalmic section was: "The Affections of the Eye Produced by Undue Exposure to Light." Reports were made by J. Herbert Parsons and Carl von Hess.

Both reports considered eclipse-blindness, snow-blindness, electric ophthalmia, glass-workers' cataract and similar diseases. No important new facts or theories were brought forward concerning this group of diseases. They agreed that the ultraviolet radiations cause ophthalmia electrica and snow-blindness (the lesions being superficial.) That the intense visible and infrared rays (often called heat rays, though all rays, infrared, visible and ultraviolet are heat rays) cause eclipse-blindness, the chief lesions being retinal. That exposure to intense artificial light can cause both the ultraviolet and heat effects, the former producing superficial lesions of the cornea and conjunctiva, if very intense, of the lens, and according to Birch-Hirschheld, of the retina, though no others have corroborated this, and recent experiments in Boston make it doubtful; and the latter producing retinal lesions

and possibly lenticular and, if very intense, corneal. Radiations affect only those tissues by which they are absorbed, not those by which they are transmitted. Thus the ultraviolet rays which are absorbed so quickly exert their baneful influence on the superficial tissues which absorb them and do not harm the retina because they fail to reach it in sufficient quantity. On the other hand, the visible and adjoining infrared rays are absorbed in such small degree by the cornea and lens that they cannot injure these unless they are present in truly blistering intensity, but are passed on to be absorbed by the retina where, therefore, their chief effects are felt.

In addition to these topics, dealt with by both, Parsons called attention to some matters concerned with the physics of light, and Hess called attention to the slender basis on which current views about photophobia rest and ventured the assertion that daylight of ordinary intensity is incapable of directly harming either the sound eye or the diseased eye, including not only superficial diseases like phlyctenular inflammation, but parenchymatous keratitis, iritis, chorioiditis and even retinitis.

Thus these two writers dealt with the pathological lesions, inflammatory and the like, produced by radiations of an intensity far exceeding those ordinarily worked with. They mentioned the effects of working with lights under ordinary conditions only to point out that there was no danger of photophthalmia[1] or other similar effects under these conditions. Is it not worth while to call attention to the fact that these matters of eclipse blindness, snow-blindness, electric ophthalmia, glass-workers' cataract, interesting and important as they are, are really subordinate in every-day practice, and as I believe in scientific interest, to the less striking and dramatic but infinitely more numerous cases of ocular discomfort and loss of efficiency due to working under improper methods of illumination with lights of ordinary intensity.

Under ocular discomfort I include the usual symptoms which come on when one reads or works with unsatisfactory light, that is, one whose eyes are sufficiently sensitive or vulnerable. Some can work or read without discomfort under conditions which are intolerable to others, reading for hours on moving cars, or with glaring lights, or with too dim light; just as some can tolerate uncorrected or imperfectly corrected hypermetropia or astigmatism or ill-adjusted glasses. I am fond of comparing this problem with that of the digestibility of various articles of food. Test them on a

1. A convenient word coined by Parsons to include the inflammations caused by exposure of the eye to intense radiations.

man with a good, strong, healthy digestion and you find no discomfort following a meal which would half kill a person with weak, defective, vulnerable digestion. To find out what things are hard to digest you must make your tests on persons who are susceptible, not on those who are tough and insensitive. The same principle applies to the eyes. To take the opinions of strong healthy men, working in a shop or other workroom, on the question whether the method of lighting there used is trying to the eyes will not be fertile in profitable answers; few, if any, will have complaints to make of methods of lighting which might soon produce great discomfort and disability in persons with sensitive eyes.

The symptoms of ocular discomfort may be classed under three heads: 1. Sandiness, a conjunctival sensation. It includes heat and itchy, scratchy, dry feelings. 2. Tired, aching, painful feelings in the eyeball and often in the head. 3. Blurring.[2]

The loss of efficiency is due to the blurring and the inability of the eye to respond to the (for it) excessive demands made on it to adapt itself to unfavorable conditions. It may amount to total disability to use the eyes or merely to inability to accomplish as large an amount of work as could be done under favorable conditions.

When we try to analyze the problem of how imperfect illumination can cause these symptoms, there are just three factors to consider: (a) the quantity, (b) the quality, and (c) the distribution of the light.

Quantity.—On the question of quantity or intensity of light as affecting seeing, very important fundamental work was done long ago and the law known as Fechner's law established. If we look at a picture or scene of which the various parts present a wide range of light and shade with many gradations, the distinctness with which the details of the picture are seen does not change whether we view them with strong or weak illumination *within rather wide range.* This is because the eye can adapt itself to a very wide range of intensity of illumination. Within this range, differences in the intensity of light appear equal in sensation if they form an equal fraction of the total quantity of light compared. This is true of other senses beside the light sense. For example: In comparing the weights of objects, if we can distinguish between 10 and 11 ounces we shall also distinguish between 20 and 22 ounces, 50 and 55 ounces, 100 and 110 ounces. In each case the second is the same fraction heavier than the first, namely, 10 per cent. So with light; if we distinguish the brightness difference

2. An excellent account of these symptoms is given by Black and Vaughan in Jour. Am. Med. Assn., Sept. 27, 1913, Part 2.

between two adjacent surfaces when the light of one equals 100 units and of the other 101 units, we could as well distinguish if one equaled 200 and the other 202 units, or one 1,000 and the other 1,010, in each case the difference being 1 per cent. Only when the intensity of illumination is reduced below a rather small minimum or increased above a rather high maximum, does this law fail. While we can see by the light of the full moon or by the light of the mid-day tropical sun, these extremes are beyond the range for which the law holds good. They show how far we must go to reach an intensity to which the eye does not adapt itself.

However, when we consider the capacity of the eye, not simply to see but to see comfortably and work efficiently, the range is much less extensive. It is found to depend on various other factors which we shall soon take up. Thus, with a light of suitable quality, properly diffused and distributed, the intensity can vary widely without impairing the comfort of the eye or its efficiency; but, when the lighting does not fulfil those conditions of distribution and quality, the eye can work with comfort and efficiency over a very much narrower range of intensity, if at all. There are many applications of this principle. Suppose, for example, we have to light a room in which many must work. It is impracticable to have exactly the same intensity of illumination in all parts of the room; but, if the quality and distribution are properly cared for, the differences in intensity (within a considerable range) will not matter at all, either as regards comfort or efficiency.

It is perfectly obvious that working with too dim a light will cause ocular discomfort; so will working with too strong a light; and that is getting to be the more common of the two, since more and more cheap and efficient sources of light are devised. These facts are so obvious that we need not tarry to discuss them further. Many violate the laws of hygiene by working with too little or too much light, but it is usually through carelessness, not ignorance.

From an engineering point of view, quantity and intensity are very important and have received much attention for the obvious reason that on them depends so largely the question of cost, but this is outside our present discussion.

The mechanism by which the eye provides for changes in the intensity of illumination is a twofold one: first, by controlling the amount of light that enters the eye, and second, by the process of retinal adaptation. The iris by varying the size of the pupil, the lids by closing more or less, and the brows and accessory parts by further shading the eyes, all regulate the amount of light entering the eye and do it rather promptly. The action of the pupils is

wholly automatic, that of the lids and brows partly automatic and partly under control of the will.

Frequent changes in intensity, such as we get with a flickering light, are not well borne and quickly cause discomfort. The eyes vainly try to accomplish an effective and stable adjustment which will secure a steady flux of light into the eye, and the futile but persistent automatic efforts to do this cause discomfort very quickly and surely. Another way that flickering acts to cause discomfort will be mentioned later. Less frequent changes can be followed and taken care of by the adjusting mechanism, but it is doubtful if the process ever is, as suggested by Black and Vaughan, a restful one. Most of us will agree that a steady light is more restful than a fluctuating one, even if the fluctuations are slow and gradual.

It is important to remember that not all the retina is capable of causing these adjustments of the pupil to changes of light intensity. Only the macular region and the immediately adjacent parts of the retina within a radius of less than 5 mm., perhaps less than 3 mm., have much if any activity of this sort. Also, it is probable that special fibers (pupilomotor fibers) transmit the centripetal impulses which form the first part of the reflex arc concerned in pupil reaction to light. Of course, when a light is thrown on the periphery of the retina, outside this pupilomotor area, some light is dispersed and diffused over the whole retina and therefore some falls on the sensitive central area and a reaction is caused. With suitable apparatus and precautions for this source of error, there is no difficulty in showing that the periphery of the retina does not possess pupilomotor activity. The pupil, lids, etc., provide for more or less sudden changes in the intensity of the light, but gradually, as retinal adaptation takes place, the pupil tends to return to its previous average size.

The process of retinal adaptation is a physiochemical one. The shape of the cells, the distribution of the pigment, the quantity and distribution of the visual purple and perhaps other similar substances are features of the process. There is no reason to believe that ocular discomfort is dependent in any direct way on the visual purple as has been suggested by some. The rods are specially fitted for seeing in dim lights and the cones for lights like daylight and artificial lights of comfortable intensity. Therefore the peripheral parts of the retina are dark-adapted, since the rods greatly outnumber the cones, while the reverse is true of the macula, where the cones outnumber the rods ten to one. It is of interest to remember that the actual intensity at the retina is about 1/25 the illumination of the object looked at, varying with the size of the pupil.

We may sum up the matter of intensity or quantity of light by saying that while it is of great importance from many points of view, and while too little or too much light causes ocular discomfort and loss of efficiency, yet the necessity of regulating the intensity is so obvious and the eye is so capable of adapting itself to different amounts of light, that the factor of quantity is not at the present time of great importance in studying the problem of ocular discomfort.

When we ask what effect *quality* of light has in causing ocular discomfort, we simply raise the question, Does the wave length of radiations, for that is what we mean by quality, make a difference to the eye? Now, the most striking differences in the properties of radiation are just those which depend on wave length, namely: visibility, color, chemical effects and heat; so that it is evident that the wave length is a very important factor to consider. Without going into the interesting subject of the properties of different wave lengths in general, we must limit ourselves to their effects in causing ocular discomfort.

There are three things to consider: (a) The influence of infrared, (b) ultraviolet and (c) visible rays. When rays strike a body, they are either transmitted or absorbed. Those that are transmitted produce no effect on the body transmitting them; those that are absorbed are converted into some other form of energy. Any form of energy when destroyed gives rise to an exactly equivalent amount of some other form of energy. If we interpose in the path of radiating energy, such as ultraviolet rays, a body which does not transmit but intercepts most of them (for example, the cornea), they are transformed into some other form of energy and the cornea suffers damage. In this case the energy takes some chemical or physiological form causing necrosis; but the striking feature is that the injurious effects are retarded, not appearing until several hours after exposure.

In the case of infrared rays, since the cornea transmits most of them, it is not damaged by them. Some are arrested and absorbed in the lens, many in the aqueous and vitreous, but no damage is done unless the amount of energy transformed is very great. The form it takes is heat, and it is possible to burn the cornea and lens by sufficiently intense heat. But most of these rays are not arrested until they reach the retina which, therefore, is the part of the eye chiefly damaged by them.

In the case of visible rays, they, too, when arrested, are chiefly transformed into heat and so affect the retina if they make it hot enough. But to some extent the visible rays, especially toward the

shorter wave lengths (blue and violet) have a similar action to the ultraviolet rays, and so can contribute a small share toward the peculiar damage done by those rays.

What I wish to emphasize is that it is a far cry from all these harmful effects produced by *intense* radiations to the question of ocular discomfort produced by working under *ordinary* conditions of illumination. There is, in the opinion of most writers, no question of any such direct action of the radiating energy on the tissues. The mischief is of an entirely different order. What its nature is, we shall discuss a little later after considering the bearing of the distribution of light on ocular discomfort.

Another more vexed question is whether the differences in color, that is wave length, of the light *within the visable range* of the spectrum, is a factor in causing ocular discomfort. Thus, is a yellowish light better than a whiter or a greener light, etc., or if a Welsbach light is objectionable, is it because of its quality or for some other reason? Is the Cooper-Hewitt mercury vapor lamp harmful because of its color? Is the light of the kerosene student lamp so agreeable because of its yellow color? We cannot answer these questions with absolute positiveness at present. Those who believe that color is an important factor have failed to prove their case. Perhaps they overlook other more weighty reasons. For myself, I am somewhat undecided, but lean toward the opinion that color is an unimportant factor if all other conditions are favorable. I am sure that in some of the cases where trouble has been attributed to the color, other factors of more importance have not been eliminated. Still, I believe that the eye has preferences in the matter of color, and so, if I were selecting a light to be as perfect as possible, I should be careful about the color, but I should be far more careful about other factors. Probably I should be guided in the matter of color by aesthetic considerations more than directly physiological ones. Thus, I do not agree with Black and Vaughan who proposed at the Minnesota meeting of the American Medical Association the hypothesis that the reason artificial illumination causes ocular discomfort is because the eye has not been fitted by the process of evolution to tolerate light which differs from day light by containing a so much greater proportion of infrared rays, only a small part of the total energy radiated by ordinary artificial sources of light being of the wave lengths which are useful for seeing. They further suggest that the retinal purple has something to do with this.

With this very brief reference to some of the considerations involved in the question of quantity and quality of light, let us pass

to the third factor, distribution. As has been said, quantity is important but fairly well understood and easily controlled. Quality or wave length is of importance aesthetically and on grounds of efficiency; but it has not been proved to be of importance as a factor in causing eye-strain. Practically all writers agree that distribution is of very great importance as a factor in causing ocular discomfort and loss of efficiency under ordinary working conditions. When we speak of distribution as a factor in this problem we include several subdivisions, namely, direction, intrinsic brilliancy, diffuseness, shadows and flicker.

Under *direction* the following points deserve emphasis:

1. No brilliant light source should be located so that it is visible, that is, shines into the eye when looking in the usual directions. All are agreed that an exposed light shining into the eye is a source of discomfort; the only disagreement is as to what directions are the worst. All agree that it is worse from below than from above; for example, light reflected up from the water or snow is worse than down from the sky or from the horizontal.

2. Light should not come from such a direction that it causes a glare by reflection from the paper or work we are looking at.

3. Light should not be so located as to cause troublesome shadows, for example, when writing the hand should not shade the point of the pen.

These three points are covered by the old recommendation, have the light behind and over the left shoulder.

Intrinsic Brilliancy.—This is a useful term. It makes a great difference whether the amount of light in a room comes from a small source of great intensity—high intrinsic brilliancy, for example, a bare arc; or a large source of low intrinsic brilliancy, for example, a large window by daylight or a brightly lighted ceiling by the indirect method. We must learn to think of the ceiling, walls, etc., as the sources of light, not, of course, the primary sources, but the immediate sources from which the light comes *and falls on our work*. When the sun shines in a window if we draw down a white shade the shade becomes the source of light for the room. Before that, the bright area on the floor, directly lighted by the sun, was one source; the buildings and sky, etc., visible through the window, the other sources. Only for the small part of the room where the sun was directly visible was it the immediate source of light.

Another important thing to bear in mind is that it is the light which comes from the object we are looking at (book, wall, desk, etc.) that concerns our eyes. If we carefully shade the side of our heads from a glaring light, but let it fall unshaded on the book

whence it comes to our eyes, we are not doing enough. The light on the work should be studiously considered and made right. Now a light of high intrinsic brilliancy is, of course, bad to look at and should never, in good lighting practice, be left exposed so that it can shine in anybody's eyes; but that in my opinion is not enough. I believe that the effect of reading with light from a source of high intrinsic brilliancy, and therefore relatively small size, shining on the paper, is to contribute to ocular discomfort. Of course it will do so if located so as to cause a glare by specular (like a mirror or shiny surface) reflection from the paper. But even when that is avoided I believe a source of high intrinsic brilliancy is a factor in causing ocular discomfort.

I have for years used a simple device for patients to test this in their homes or offices. Without trying to explain to them what we mean by high intrinsic brilliancy, I tell them to hold a pencil parallel to and 3 inches from their book or paper and observe the shadow. If it is daylight from a window, the shadow will be blurred; if it is light from a small concentrated source the shadow will be sharp. I tell them, if the shadow is sharp and intense, the light is not a soft, agreeable, comfortable one to work by. Such a light will cause a glare, if the paper is at all shiny. For glare from reflection is simply the blurry image of the source of light reflected into the eye. Now, if the source is not bright and intense of course its image will not be, so glare can be avoided by avoiding sources of high intrinsic brilliancy. But I repeat that even apart from ordinary glare, I believe that a source of high intrinsic brilliancy, which casts a sharp shadow, is an uncomfortable one to work by.

Lastly we must consider *diffuseness* as a subdivision of the distribution of light. Diffuse light is the opposite of directed light; it comes from many directions instead of one. If perfectly diffused, it would come from all directions equally. Of course there are no sharp shadows with diffuse light, because a shadow is a place where light does not fall; and, if it comes from all directions, there is no place it does not reach. If the light is only moderately diffused we get shaded areas as distinguished from shadows, that is, areas where somewhat less light falls. Sometimes we want no shadows; for example, when drafting, dissecting, or operating,—the shadow would obscure what we are looking at. With dense shadows we are straining to see what is in the shadow. A sharp-edged shadow may be confused with the edge of the object. Sometimes we do want shadows because without them objects stand out less distinctly. We want sufficient directed light to mark the edges of objects and improve definition. Especially are shadows helpful when there is

a lack of color differences. Absence of shadows means a flat, uninteresting effect, so for aesthetic reasons we want sufficient directed light to make some shadows. Nothing stands out with especial prominence in a diffuse light, so when we want to accentuate some feature, call attention to anything like goods displayed to attract a purchaser, we need directed light to mark the contrast and make the object stand out and attract attention.

One advantage of diffuse lighting is that it permits a larger pupil, thus admitting more light into the eye, and so making a lower general illumination suffice for good, comfortable seeing. With some patients a small pupil gives better vision because a sharper image (smaller diffusion circles on the retina)—these prefer brighter lighting.

From the above it should be clear that well-diffused light is better for most purposes, but it is wise in some cases to add some directed light. The usual way to get diffused light is to use a large area of moderate or low intrinsic brilliancy as the source; for example, the ceiling or walls, or both. This is done by indirect lighting of various forms and is one reason why indirect lighting is so much better than the old way for many purposes. Another reason is that there are no exposed visible light sources. It cannot be too often reiterated that bare, exposed, intense sources should not be tolerated in good lighting practice. The pathologists may assert that no changes in the retina can be detected from exposure to such light, but there are two other things to consider, one is that exposure night after night to such sources of high intrinsic brilliancy may so reduce the resistance of the tissues as to make them more vulnerable to other damaging agents. The other is that the tax on the adjusting mechanism of the eye causes eye-strain, which, though unaccompanied by any histological changes, is none the less a very real and important thing for ophthalmologists to consider. This brings us to the somewhat puzzling question:

HOW OCULAR DISCOMFORT IS PRODUCED BY FAULTY ILLUMINATION

Obviously this is a fundamentally important question for us as ophthalmologists. What hypotheses have been suggested? By common consent all writers on the subject seem to admit that the sensations of pain, as well as the tired blurry feelings are of muscular origin, have their source in the intra-ocular or extra-ocular muscles. As to the other sensations, which I grouped as conjunctival, there is no general agreement as to how they are produced. It is evident that their seat is in the conjunctiva, and I think we may safely say that most of the symptoms in this group can be

explained on the basis of hyperemia of the conjunctiva. The question is how hyperemia is produced.

I have tried to take the various suggestions proposed and unify them into a consistent and convincing hypothesis. I have utilized the little that I have found in the literature and made free use of what I have learned or had suggested to me in conversation with numerous colleagues, to whom I am duly grateful, though as is often the case, one cannot trace the source from which each idea had its origin. I have not succeeded in finding out who first suggested that the sensation of pain caused by exposure to faulty illumination was of muscular origin. Magendie in 1824 showed that the retina was insensitive to pain. It was an easy step to the conclusion that the pain was felt through the trigeminus nerve, but that the muscles were the primary occasion of the disagreeable feelings is not so obvious, and I should very much like to know who pointed it out.

In attempting to formulate a comprehensive theory about it, the first thing is to have a clear idea of what we want to explain. We have three groups of symptoms: first, the local hyperemia of the conjunctiva, and consequent dry, hot, scratchy feelings and redness; second, blurring, which comes and goes; third, the various forms of pain, dull, aching feelings, sharp darting stabs, sleepiness, difficulty in keeping the eyes open, etc.; and lastly, the headaches of various sorts. The next thing is to eliminate such factors as we can. I think we can safely exclude any direct action of the light, as light, or radiation as radiation. The harmful effects produced by these agents are entirely different in character, as stated above.

The next thing I would call attention to is the *striking similarity of the symptoms arising from eye-strain due to faulty illumination, to the symptoms of eye-strain arising from working with uncorrected errors of refraction.* This similarity of symptoms is certainly a hint to look for a related cause. Now the cause of eye-strain, due to errors of refraction, is fatigue and exhaustion of the muscular and nervous control of the mechanical adjustment of the eye. All the above-named symptoms can be explained by (*a*) hyperemia of the conjunctiva and other parts of the eye; (*b*) fatigue of the ocular muscles concerned in mechanical adjustments of the eye. The adjusting mechanism of the eye is a threefold one: first, the adjustment for *intensity* of light (lids, etc., pupil, retinal adaptation); second, for the *distance* of objects (focusing or accommodation); third, for the *position* of objects (fixation and convergence). The suggestion is obvious that the way faulty illumination affects the eye is through the mechanism of adjustment for intensity of light. But we have already said that intensity is not an important factor.

The mechanism for adjusting the eye to intensity is so automatic and smoothly working that we have little trouble from its derangement in ordinary cases. Only in such unusual conditions as albinism, retinitis pigmentosa, nyctalopia and the like, does this mechanism break down.

There is one exception to this. The periphery of the retina lacks the mechanism of adjustment; it can neither regulate the amount of light by controlling the pupil, since that is the exclusive function of the central retinal region, nor can it adapt itself to the changes of light by the mechanism of retinal adaptation, since the periphery of the retina is perpetually dark adapted, owing to the lack of cones and predominance of rods. Here we have a clue to the way a strong light, falling obliquely on the eye and so striking the periphery of the retina causes ocular discomfort. This part of the retina does not tolerate such light well because it has no adequate mechanism to adjust itself to varying intensities of light. The dark-adapted area being exposed to strong light, there ensues a hyperemia of the retina and chorioid and if the process continues, there follows a hyperemia of the conjunctiva and of other parts of the eye. Hyperemia of the conjunctiva will explain the symptoms in its group; hyperemia of the ciliary region will throw light on the other groups.

Another factor, which has been suggested by Ferree, is this: When a bright light strikes the periphery of the retina, the first and most fundamental impulse is for the eye to turn and fix it. Now this impulse has to be inhibited. Thus the muscles are stimulated by the impulse to fix, for it is a fundamental law that even when an impulse is held in check so that no motion appears to the observer, stimulus is sent through the motor nerves. This has to be held in check by a counter stimulus. This is fatiguing to the muscles, and so causes hyperemia and its train of symptoms and fatigue of the muscles and its train of symptoms.

We can discuss the various factors of distribution as well as those of quality and insufficient intensity together. Any fault of illumination results in producing unsatisfactory retinal images—too faint, too bright, of objectionable color, blurry—in short, they interfere with easy and quick perception of what we are looking at. Result, increased efforts on the part of the eye to secure better images on the retina, that is, more sharply focused, more accurately fixed on the fovea, more satisfactory in brightness. These effects mean whipping up the ciliary muscle to more perfect focusing, the fixation muscles to more perfect fixation and convergence and iris to more satisfactory adjustment for quantity of light. As a result they are

fatigued. The reparative anabolic processes in the muscles go on at the same time with the processes of breaking down, which accompany muscular activity. Under favorable working conditions, the building up does not lag far enough behind the breaking down to cause uncomfortable sensations (fatigue, etc.). But let a little greater demand be made and the margin of safety or reserve is passed, and fatigue follows. Thus it is easy to see how working the muscles of the eye a little harder will produce symptoms of discomfort, although the work is quite physiological and such as the muscles are made for. It also explains why some will feel the symptoms and others will not—the margin of safety of the latter is greater, their anabolic processes keep ahead of their katabolic, they do not spend beyond their income, and so they avoid the discomfort which is sure to follow.

Now it may be thought that when we read or work, we are focusing and fixing the objects we are looking at and to speak of the eyes as making efforts to focus and fix better—more sharply and accurately—is rather drawing on the imagination, is a figure of speech and a rather vague way of trying to explain the fact. Not at all. When we read a book under favorable conditions, we do not by any means focus and fix each word, far less each letter of the line, as our eyes pass quickly and jerkily across the page. We take it in without the need of any such accurate and painstaking process. Now let the conditions be made unfavorable, the images on the retina are too unsatisfactory and the eye strains to compensate. It matters not whether the cause of the unsatisfactory image is ametropia, dim light, glare, flicker, a shadow thrown across the page, a light shining into the eye, whatever it is—the eye tries to improve the image so that the perceiving of what is being looked at will be easier and more satisfactory.

Consider particularly fixation as an example. We do not as a rule fix so accurately as to throw the image just on the center of the fovea. This is proved by the action of after images. Fix a bright object of moderate size, such as a gas flame in a dark room, then extinguish the light and observe the after-image. It will almost invariably appear to move. That is because the image is not centered on the fovea. By the direction the after image moves, you can tell whether you looked a little below, or to the right, or left, or above the center, because the image will move up, to the left, right or down, as the case may be. Experiments of great sensitiveness can be made with after-images to show how the eyes move about when they are supposed to be fixing a definite point and are trying hard to do so. In the case of accommodation, it is probable that

the eyes do not under ordinarily favorable conditions make the most sharp and precise images on the retina of which they are capable, and so can be whipped up to more perfect work when occasion arises, but at the expense of much greater fatigue.

This, then, is my explanation of eye-strain from faulty illumination. We are able to see well enough for ordinary conditions without exerting our maximum nicety of adjustment. But, let conditions become unfavorable and the eye tries to make up for that by more perfectly adjusting all parts of the mechanism which can contribute to better seeing. Hence the symptoms of eye-strain from faulty illumination are so similar to those of uncorrected errors or refraction and the like.

Compare the effects of trying to read on a moving train with the effects of a flickering light. In the first case, in order to follow the irregularly moving page, we have to fix and focus the lines, the words, and even the letters with a far greater degree of accuracy of adjustment. The strain is obvious on the adjusting mechanism and on the attention. Similarly with the second case, that of flickering light, the eye tries to compensate for the wavering, varying intensity by an adjustment which will give a steady flux of light into the eye; also, being unable to do this, though still automatically keeping up the attempt, a tax is put on the perceiving part of the mechanism; the image being a varying one, the brightness of an area is no sooner perceived than it changes to the brightness of an adjacent area, which, an instant before, presented a contrast. It must be remembered that the eye is normally shifting its fixation almost incessantly, so that, in fact, it requires great effort not to do so, but to fix steadily a given point. When we look at a page or a picture, a room or a landscape, or even a face, the eyes move rapidly from point to point, exploring it, and mentally recording the impressions of the various parts and constructing an idea of the whole. Now, if the parts do not preserve any steady relative values of brightness, a chaotic condition results and to make something satisfactory out of it, the eyes try to get a better image of each momentarily fixed spot, try to flit more rapidly and fix more precisely and in short struggle to overcome a handicap in these and other ways.

Examples applying the principle to glare and other faulty conditions could be cited, but I have given enough to show what my theory is. Now a word as to practical application. I shall not cite cases, but hope some of you may do so. It is certain that there are many patients whom we try in vain to relieve of symptoms which point unmistakably to eye-strain whose refraction we have gone over with the greatest care; perhaps finally we have to order a

prolonged rest, as the only way to relieve them. Let me suggest that before doing so you investigate the conditions of lighting under which they work. See to it that there are no exposed visible sources of light of high intrinsic brilliancy to shine into their eyes or to make glare by reflection from desk, paper or other objects. See to it that the light comes from the right direction, that it is sufficiently diffused. Try the simple test of observing the shadow cast by a pencil held three inches from the paper. If they have colors to discriminate in their work see to it that the lighting is of proper quality to make this easy. Do not hesitate to advise improved methods of lighting because they may cost more The facts are that it will cost a little more if properly designed and will earn much in efficiency and comfort.

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DISCUSSION

DR. ROBERT SCOTT LAMB, Washington: I wish to congratulate Dr. Lancaster on the timely and scientific paper he has presented. The first thing we must do as ophthalmologists is to convince the builders, engineers and architects of the economy in factories and in buildings generally, of an illumination that will bring about the best interests of the operatives and facilitate their work to the greatest degree. I can illustrate this. At a meeting held in Washington by the illuminating engineers and architects some time ago, which I was asked to attend, I enjoyed very much hearing their point of view. One particular fact was brought out: that in a factory in Rochester they had a row of lights in the center of the work benches (for economy's sake), so that the light went down on the lathes on either side, and incidentally it struck the men in the eye. So many of the men had eye trouble that they were at a loss to understand the source and called in a consulting engineer from New York. With increase in quantity and cost of maintenance, they have rearranged the lights with no benefit to the men. In fact, it was even worse. After the consultation the lights were rearranged so as to come from behind the men, striking the machine and glancing off away from the eyes, with the result of an immense amount of saving to the factory.

We have with us in Washington a Government Printing Office and Bureau of Engraving and Printing, where they are now using a very heavy Tungsten light. It does not make any difference, in my experience, what color the light is; it is the intensity, and somewhat the direction.

The distribution is something we have not taken up at all. The wavelengths should be considered, as this is not a negligible quantity.

I think there can be no doubt that retinitis, chorioretinitis and chorioiditis are more prevalent than we fully realize. Many patients in the early stages get well, and many of them get well by going for a vacation. Those I have seen in the early stages have not the inflammation well marked, but

depending on your own color sense whether you recognize it. I have in mind a man who never sees a slight redness because he is color blind.

As to the diffuseness of light and the distribution of it, this has been taken up more thoroughly by the manufacturers of lamps and illuminating engineers, and we want to help them. We cannot afford to stay in a brilliantly lighted room. We have plenty of green outdoors, which is soft and restful to the eye, but we make our room a lovely blue or a damnable red, and it is shocking to the eyes. It hits you in your face wherever you turn unless you are careful to avoid it. Stay out of the red room. Contrast is what we want to study, light and shade, the painting of the walls in softer colors and the harmonizing of furniture to the walls. The closer we bring these facts to the illuminating engineers connected with factories and architects in building our homes, and get them out of the idea that it is expensive to do this (they are hunting for a cheap house to make a show, and of course that idea cannot be got rid of in one generation), the better will be the effect on houses as well as eyes.

Nothing can be added to the lucid and ingenious explanation Dr. Lancaster has given as to the way the injury is brought about. I congratulate him very highly on this.

Dr. F. Park Lewis, Buffalo: I want to congratulate Dr. Lancaster on his original and valuable paper. The pernicious effect of a closely approximated light source of great brilliancy in producing temporary amblyopia has recently been demonstrated in a case of my own. A hospital clerk complained of occasional loss of sight in the right eye, vision would suddenly disappear only to reappear again after an interval of time, varying from a few seconds to the longest period, which was six minutes. The explanation was found in the fact that she was working within 1 foot of an intense Welsbach light, shaded only by ground glass. On the use of a proper shade and the removal of her books 3 feet from the light, the temporary amblyopia ceased and did not recur.

Monochromatic light can be productive of injury. From spectroscopic investigations by Bell, the only red portion of the spectrum found in this light is a narrow line. Red enters into much of the printed and written material; just to the degree that this occurs the absence of red portions of the spectrum makes it difficult to read. This light is used in all of the postoffices and the employees constantly suffer from their eyes.

I am afraid we will not be able to instruct the illuminating engineers on the physics of light. The transactions of the Illuminating Engineering Society is full of most careful studies on this subject. They have opportunities for laboratory studies, for the making of spectroscopic and photometric tests that we lack; they lack the knowledge of pathological conditions which we could supply. Much could be gained by working in cooperation with them.

Dr. Moulton, Fort Smith: Nearly every case of asthenopia that comes to me, I inquire into the direction of the light and I frequently find that people who use the pen or needle have the light, artificial or daylight, fall from the wrong side. I ask them if they did not know the light should fall from the left side. Sometimes they say yes and sometimes no. If they think it should be from the left side I ask them if they know why and they frequently do not, and I call their attention to the shadows. Sometimes I make a practical demonstration to them with pencil and paper, with the light first from one side and then from the other, and usually they come to understand it in this way.

Dr. Harry Gradle, Chicago: Indirect illumination is a beautiful illumination and very satisfactory for general illuminating purposes. I have it in my home and have found some decided disadvantages. In read-

ing under indirect illumination the eye tires more readily than when the light is concentrated. This is probably due to the lack of shadows and due to the difference in the size of the pupils and the difference in the amount of light entering the eye. This is noted in sewing, as shadows cannot be seen on white cloth with white thread. In incipient cataract the indirect light is impossible to read under. Here they require the full dilatation of the pupil in reading, and in indirect light they tire very quickly. But for general illuminating purposes the indirect is certainly the ideal method of illumination.

DR. W. REBER, Philadelphia: I take it the greatest point of interest in Dr. Lancaster's paper is that he has pointed out the social relation of the ophthalmologist to the community. This relationship is greater year by year. The illuminating engineers have looked to us for help. It might thus be summed up: Produce the best light consistent with the efficiency of the eye.

It seems from the discussion to-day they have overshot the mark and are frequently producing too much light. Ferree's experiments show that what we need is a large area of low intrinsic brilliancy, and not a small area of large intrinsic brilliancy, which will always produce discomfort. Thus far we have no accurate test of the efficiency of the eye. Ferree has devised a test which promises accuracy, and this, so far as we know, is the first test for the efficiency of the eye. But it seems to me that as patients are asking us more and more every day, "Doctor, what sort of light shall I use for my eyes?," we should be in a position to give them information that will be of value to them. We have not yet settled, nor have the illuminating engineers settled for us, whether it is the direct, the semi-direct or the full indirect illumination. Dr. Ives, who is working in the photometric laboratory in Philadelphia, has his home lighted with what he calls "artificial daylight," and he will have some interesting and surprising things to show us later on. There is the same soft flood of light that is characteristic of daylight, and you are hardly conscious of the source of illumination; instead of having all the illumination above and having the light fall on the lower part of the retina, he has used side lighting as we have it during the day, and this is possibly the reason the illumination is as grateful as it is.

DR. W. C. TUCKERMAN, Cleveland: What most of us need is some concrete example to appreciate the effect of lighting. We have to consider both the question of intensity and direction. Everybody knows that in snow blindness too much intensity has injured the retina. As the chairman sits there before us his features are very indistinct. The reason is that the light is behind him. The first thing one thinks of is to increase the intensity. Instead the direction should be changed. If we increase the strength of the lighting, we are tending toward the condition that causes snow blindness with no improvement in the distinctness of the chairman's features. The light shines into my eyes and makes my pupils contract so as not to let in too much light and then the light reflected from the chairman's face is relatively too little to produce a clear image on my retina. The size of the pupil does not depend alone on the light reflected from the object viewed, but on the total amount of light entering the eyes. For best vision the most of the light entering the eye should come from the object viewed.

In the electric fixtures in front of me the diffusion of the light is only a partial success because ground glass was used where opal glass should have been. The diffusion of the light makes those lights less annoying to me, but their position is such as to still give annoyance, while the lights

behind me, which are pleasing to me in every respect, shine directly into the chairman's eyes and annoy him.

Indirect lighting is best because reflected from the ceiling the light is diffused and the direction is such that the eyebrows shade the eyes, and the pupils can relax sufficiently to get good vision. The importance of having a rough surface for the ceiling is to make the light diffuse and to prevent a mirror effect. For the same reason a paper with a rough surface is easier on the eyes than one with a glazed surface. When glazed you have to avoid holding your paper at a certain angle to escape the mirror effect.

In these lighting problems one must decide what is needed for the particular work in view and then arrange the fixtures to meet that requirement. For reading or writing, a light over the left shoulder is well enough, but for drawing it is inadequate, because you still have shadows interfering. For drawing, the light should come from in front, but if the angle is wrong there will be a direct reflection into the eyes from the paper, even though the light itself be shaded.

As physicians we should protest against lighted rotary wheels, glaring stationary signs and other like atrocities. The periphery of the retina is intended by Nature to protect us by calling attention to moving objects. On account of the taking advantage of this fact by advertisers, in many of our cities we need to keep our eyes covered when walking on the streets at night. It should be a crime to allow to be placed on the front of a bank a large brilliantly lighted sign which people are compelled to face every time they walk down the street. We likewise allow buildings to be erected with white glazed surfaces for outside walls. Most of our pavements are glaring white and they reflect the light up into that part of the retina not used to it. It is many times not the heat but the dazzling light in cities that prostrates people, as one can readily ascertain for himself by the immediate relief when you come to an open space where there is a green expanse under foot.

Dr. W. B. Lancaster (closing discussion): I am much gratified by the interest that has been shown by the discussion. It shows that we are progressing because at the Minneapolis meeting of the American Medical Association there was no discussion by members of the paper on a similar topic, but only by invited guests.

With regard to deciding on the merits of different methods of lighting, we have three means of approaching the problem: one is to consider the theoretical reasons why one should be better than another. That is unsafe. The second method is to take the consensus of opinion of a great many who have tried different methods; enough evidence would be reliable. For example, one speaker here said that indirect lighting was not suitable for reading. That is not enough evidence. Hundreds of instances on the other side could be cited to show that it is the very best by which to read. That must carry more weight. In the cases where it has failed, probably there was some other factor that was at fault, such as insufficient intensity or something of that kind. The third means is by laboratory experimentation, and in this there was not much progress made until Ferree devised the method alluded to in this paper. His results are interesting, though they have not yet been confirmed. He found that with indirect lighting the falling off in visual efficiency after reading three hours was no greater than after reading the same length of time by daylight. Whereas the falling off in efficiency of the eyes after reading three hours by direct light was 50 per cent. So where there may be some instances where the indirect lighting has failed to give satisfaction, the overwhelming weight of evidence is in

its favor. It would be suitable for a foundry where they need direct lighting to show up shadows.

DR. REBER: You mean the shadows are necessary for safety?

DR. LANCASTER: Yes; and also in the case of work where there are no color contrasts, since when we lack the help of differences in color we have to rely more on the shadows to distinguish between objects which otherwise would blend together in a very confusing and trying manner.

DR. REBER: That would be the case in many kinds of sewing.

A MEMBER: Shadows are necessary in many kinds of microscopic work.

DR. LANCASTER: I would recommend my colleagues to read what has been published by the illuminating engineers in the Transactions of their society. These Transactions also contain papers by a number of medical men, some of them members of this Academy. They contain much information valuable to us in our daily work.

Let me also call your attention to the "Primer of Illumination," which is a good thing for us to have to give to our patients. I also tell them to use the test with the pencil which is mentioned in the paper. When you hold a pencil a few inches from a paper so that the shadow it casts may be observed, you can get a good idea of the character of the light. Tell them when they go home to hold a pencil 3 inches from their book or paper and note the shadow cast on it. If it is good daylight which they are testing, the shadow will be blurred and indistinct. If it is a bright intense, concentrated light, such as the direct light of the sun or an arc light or a bare incandescent light, the shadow cast is clean and sharp in character. In proportion as the shadow has distinct outlines the light is bad.

EDEMA OF THE MACULAR AREA OF THE RETINA

WITH A REPORT OF CASE

CHARLES C. STUART, M.D.
CLEVELAND

The history of the case, which is presented for your consideration, is that of a young married lady, aged 24, who first came under my observation on Sept. 15, 1911, or slightly over two years ago. She was referred to me by Dr. F. C. Herrick of my city.

About ten days before coming under observation, she began to have severe headaches; four days later, in addition to headaches, which were becoming worse, blurred vision was noted. This began in the right eye and later involved the left eye. With the appearance of the latter symptom there was nausea and vomiting once or twice daily, and this continued three days. At this time also a fresh cold in the head appeared with some nasal discharge, but no nostril occlusion. At the time of examination, this had disappeared except for a slight catarrh, which is always present. Such were the prodromal symptoms.

In the family history everything is negative. The parents are alive and well. We were able to question them thoroughly and nothing suggestive could be obtained. The Wassermann reaction was tried on each one and found negative. The patient had been married fifteen months, and a questioning of the young husband revealed no venereal history, except one attack of the Neisser infection contracted long before marriage, which was most carefully cared for by Dr. Herrick over a long period of time, until a most careful scrutiny of urine revealed no shreds or other evidence of the infection; his Wassermann reaction was also negative.

The results of physical examination of the patient are negative as to heart, lungs, abdomen and urine. A test of subcutaneous injection of tuberculin is also negative; her Wassermann reaction is negative; the patient was not at the time and never had been pregnant; menses are always regular, without pain, and the last one began August 30, or two weeks before coming under observation.

The examination of the right eye shows a clear media, the disk edges hazy and somewhat concealed by edema, veins large, tortuous and congested, arteries tortuous and in places reduced in caliber. The fundus surrounding the nerve is edematous, especially in that

area between the disk and macula. A similar condition exists in the left eye, except that the nerve head is more visible.

At the time of the first examination the vision of the right eye was 3/50 of normal, and of the left eye was 6/20 of normal. There are no hemorrhages in either eye. The instillation of atropin in each eye was begun. The next day, the eyegrounds were again carefully inspected. The irides dilate evenly, fully and show no signs of iritis. By scope, disk edges are noted as covered with edema, as before stated, but there is no gross protuberance of papilla above surrounding tissue. The condition of left eye is the same as that of right eye, but disk outlines are seen slightly plainer. At this point in time I was taken sick, and during a period of ten days the patient was under the care of my colleague, Dr. W. E. Bruner. He has kindly allowed me to make use of his notes and I quote his examination on the 19th: Right eye media clear, disk round, all edges entirely hidden, but still slight cup showing, veins congested, arteries rather narrow, but tortuous; very marked neuritis or papillitis, though no definite swelling of nerve above rest of fundus. Fundus surrounding nerve edematous, especially from nerve to macula and beyond; no hemorrhages; no spots of exudate in fundus. Left eye: similar equally marked neuritis or papillitis, but no more definite swelling; similar edema of retina. At this time right tonsil showed a white spot, and there was a slight hypertrophy of turbinate of the left side. The fields showed no central scotoma for form or color, but an enlarged blind spot for color in each eye.

September 23: Dr. Herrick reports lumbar puncture suspicious; that is there was an increase in the globulins. On this day vision was:

O.D. $+ 3.00^{s}$ V = 6/30
O.S. $+ 2.00^{s}$ V = 6/22

September 26:

O.D. $+ 4.00^{s}$ V = 6/60
O.S. $+ 4.50^{s}$ V = 6/30

Scope examination shows papillitis as marked or even more pronounced. Surrounding retina swollen in each eye. Veins full and tortuous. In O.D. a flame-shaped hemorrhage is present at outer edge of disk; none in O.S. Again, form field taken and found normal.

At this time the nose and accessory sinuses were carefully examined by Dr. Lenker and found normal. The case returned to my hands for care on September 30, and my notes show on that day:

O.D. $+ 5.00^{s}$ V = 6/20
O.S. $+ 2.00^{s}$ V = 6/16

Scope examination shows the swelling greatest at the macula, and smallest at the nerve head. A slight hemorrhage is seen in O.S.

October 4:

O.D. + 5.00^{s} V = 6/25
O.S. + 6.00^{s} V = 6/16

October 7:

O.D. + 7.00^{s} V = 6/40
O.S. + 7.00^{s} V = 6/20

The edema in each eye is greatest as one approaches the macular area.

October 11: A few spots of iritic adhesion are noted on the anterior lens capsule in the right eye and one spot only in the left eye. The swelling is confined to the macular area, and to-day there is noted for the first time a few discrete white spots not unlike those of a chorioiditis in the nasal periphery of each eye ground.

O.D. + 8.00^{s} V = 6/20
O.S. + 7.00^{s} V = 6/25

This is the time and amount of greatest edema, and from this point on, my history notes show a gradual subsidence observed by the scope and measured by the gradual decrease in strength of convex spherical lenses used in testing the vision.

November 9:

O.D. + .75^{c}x90 V = 6/20
O.S. — .50^{c}x180 V = 6/16
Binocular V = 6/13-2

The scope examination now showed the edges of the disk. In the macular area, a wrinkling occurred as evidenced by white bands extending from the disk to the macula.

November 22:

O.D. + .25^{s} + .75^{c}x90 V = 6/16
O.S. + .75^{c}x180 V = 6/10
Binocular V = 6/8

Lenses are ordered on this date, to be worn constantly.

Jan. 12, 1912:

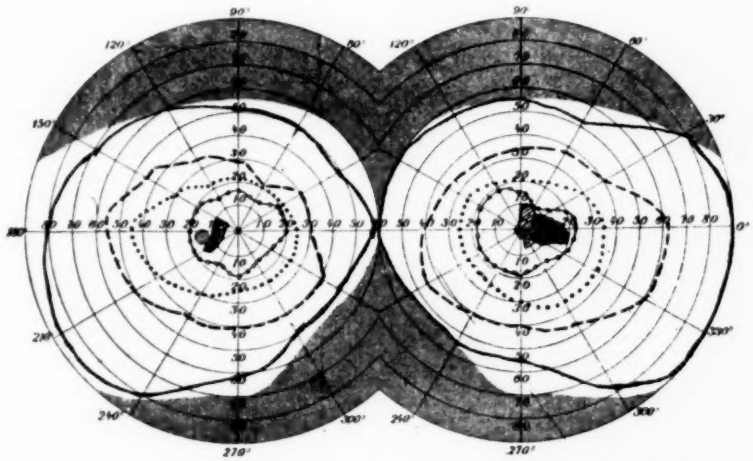
O.D. V = 6/25
O.S. V = 6/6
Binocular V = 6/6

Oct. 18, 1912:

O.D. V = 6/32
O.S. V = 6/4

The condition of the fundi as revealed by the scope in a recent examination showed, in the right eye, an area of atrophy lying at the outer disk edge; some atrophy of the nerve head, some degenerate changes in the perimacular area and some pigment disturbances over the entire fundus. In the left eye there are pigment disturbances about the nerve head and extending out to the macula and thence outward, some wrinkling of the retina. There are no chorioidal atrophic areas.

I wish also to present a perimetric chart of each eye, which shows practically normal conditions as to form and color fields, except the central scotoma for form and color in the right eye, some slight contraction for color in each eye, and a slight area of haziness in the left eye near the blind spot. The vision of the



right eye is now 6/25, and of the left eye is 6/5. The treatment of the case was symptomatic and empiric. Reliance was placed on the use of potassium iodid to reduce the edema; at the time also, moderate doses of bichlorid were exhibited. During the period of edema she was also given sweat baths. Locally, the eyes were kept at rest with atropin, and in the late stages Dionin was administered.

To give a brief résumé of the history of the case:

A young married female with no previous suggestion of taint of any kind, suddenly develops an edema of the retina of each eye: this edema is localized to the area of the papillomacular bundle of nerve fibers also involving the optic nerve. The attack is preceded by a week of almost unendurable headache. The only suggestion of lues was obtained by a lumbar puncture. The edema lasted about one month, and on subsidence left a wrinkling or rucking of

the retina with certain destruction of nerve elements in the right eye, as evidenced by decreased vision, and a return to practically normal condition in the left eye. There is now a period of two years since the attack, and the report of the case is made late enough to be assured that conditions which now prevail, are permanent. What has occurred in this pair of eyes?

Was this a bilateral lesion primarily of the uvea?

Was this a bilateral lesion primarily of the retina?

Was this a bilateral lesion primarily of the optic nerve?

CONCLUSIONS

1. Although I have given much consideration to the thought that the uvea was the seat of disturbance, I am inclined to dismiss that as the source of trouble. The iritic spots on the capsule are suggestive, as also the fact that each retina has returned to normal function. Against it lies the inability to explain the appearance of a well-congested nerve head, a slight hemorrhage and also why a retinal edema, if it were due to chorioidal trouble, should be thus localized in the area between the disk and macula.

2. Is this a primary bilateral lesion of the retina? I think not, but if so, it must have been very mild. Parsons says, "Edema of the nerve fiber layer may pass off without leaving any permanent damage, but when the internuclear layer is involved, permanent injury results." Besides, a pure retinal lesion ought not to produce the intense prodromal symptoms which this young lady experienced.

3. I am, provisionally, at least, inclined to the belief that the primary trouble lay in the papillomacular bundle of fibers of the optic nerve; that the trouble was central in origin and might have consisted of a small gumma at the center for this bundle; that the retinal and optic edema were secondary and passive, and luckily did not become intense enough to destroy terminal nerve elements.

ANOMALIES OF THE RETINAL PIGMENT EPITHELIUM AND THEIR CLINICAL SIGNIFICANCE*

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The homogeneous appearance of the normal fundus of the eye depends in part on the integrity of the retinal pigment epithelium, which acts as a turbid medium, obscuring the structures behind it. Whenever these cells contain no pigment or less than the usual amount, the chorioidal vessels become visible, as in albinos and often in myopic eyes. In the present paper, however, I propose to consider, not the absence of pigment, but the appearance due to its irregular distribution.

Structural changes in the retinal epithelium have been demonstrated anatomically by Donders, H. Mueller, Leber, Goldzieher and Fuchs, and were attributed by them to the influence of the globular hypertrophies ("Drusenbildung") of the vitreous lamella of the chorioid. According to Rosa Kirschbaumer,[1] anomalies are formed in the pigment epithelium in three-fourths of all eyes of persons over 50 years of age, but are confined mostly to the anterior (ciliary region) and extend only exceptionally toward the posterior pole. According to Kirschbaumer's description, some cells increase in size even up to six times their normal dimensions, and lose their well-defined contours. Their nuclei multiply and karyokinetic figures appear. Degeneration takes place, the nuclei refuse stains, become pale and vacuolated. In some instances the entire cell disintegrates, leaving its pigment in a mass on the basal membrane. Some cells contain an increased amount of pigment, others less than normally or none at all. The pigment grains themselves may lose their rod-like shape, and become round, small and dark brown. Larger round masses of pigment may also be seen between cells. On the other hand, rarefaction of pigment alone may occur without other visible changes in the cells. Sometimes small areas are thus formed devoid of coloring matter.

Since the changes incident to advanced age are mostly confined to the anterior part of the fundus, invisible to the ophthalmoscope, or seen only imperfectly, they seem to have been but little

* A posthumous paper by the late Dr. Henry Gradle, of Chicago.
1. v. Graefe's Arch. f. Ophth., xxxviii, 127.

studied during life. There are, however, certain easily observed ophthalmoscopic appearances which can only be referred to similar anomalies of the pigment in the retinal epithelium, although these changes have not yet been anatomically demonstrated. I refer to the stippling or granular appearance of the fundus commonly seen around foci of chorioiditis of retinochorioiditis. I have also noted the same granular condition during the retrogressive stage of optic neuritis, in which cases it seemed most pronounced in the area adjoining the optic papilla. In purely retinal lesions I have never observed this peculiarity.

The special object of this paper, however, is to call attention to the frequent occurrence of the same appearances in the fundus of children and young people suffering from severe asthenopia. While the healthy fundus of adults presents almost always a homogeneous appearance, I have observed a more or less pronounced stippling or "granular" condition in about 5 to 8 per cent. of young people examined by me on account of asthenopic complainnts. Since all transitions occur between a perfectly homogeneous fundus and the extreme granular appearance, such as I shall describe presently, it is obviously impossible to state accurately the frequency with which this anomaly occurs. By limiting myself to those records which are fairly complete in details and which refer only to well-preserved appearances in the fundus, I can base this report on the histories of forty cases. These were all instances of what I have described elsewhere as exaggerated asthenopia, ocular discomfort out of proportion to any existing error of refraction or other local anomaly present.

The ophthalmoscopic peculiarities to be described are usually most pronounced in the inferior nasal quadrant of the fundus. Less commonly they extend around the periphery of the entire ophthalmoscopic field, and least often are they seen at the posterior pole. It must not be overlooked that in dark subjects, the macular region has often normally a slightly stippled appearance, which, however, may be considerably exaggerated in these patients.

The peculiar granular appearance of the fundus I cannot describe better than by comparing it to a surface covered with a mixture of black and reddish powders, with preponderance of the latter. Most of the separate "grains" are barely within the range of visibility. Occasionally a few larger black points are seen; sometimes, but less frequently, a few white specks of pin-point size can be found. There are often in the same fundus small areas with so little pigment that the chorioidal vessels become visible. When the refraction of pigment is not so extensive, the surface appears, in the words of

Loring,[2] "not smooth and hard like a cloth with no nap to it," but "like one that has a plush or velvety feel." Some authors presumably mean this condition when they speak of a "woolly fundus." The condition is always symmetrical in both eyes, though sometimes more pronounced in one.

There are probably various reasons why these appearances have been so little noticed in literature. Occurring in eyes not otherwise diseased, they are easily overlooked, especially in the inverted image, unless especially searched for. Moreover, when not pronounced, these appearances would be classed by most observers as within the normal range unless systematic comparisons were made. Yet the infrequency of this granular appearance in perfect eyes and its very marked occurrence in connection with fresh chorioidal disease, suggest positively that it is a deviation from the normal type.

The subjects in which I have observed this peculiar fundus were all of the neurotic type. In fact, the *most striking appearances were found* in the most *pronounced cases of nervous disturbance.* The most extreme instance I have ever seen was in the case of a boy with very low vision, presumably due to some obscure brain lesion, but without ocular disease, where the fundus could literally be called finely "speckled." As evidence of the neurotic state, I have on my records the histories of frequent headaches, chorea or habit spasm, general restlessness, emotional irritability and sometimes other manifestations of general neurasthenia, such as fatigue on slight exertion and insomnia. Very frequently the nervous condition was due to heredity. In other instances it could be referred to improper nutrition during infancy. In some, presumably digestive disturbances were of influence, and a few times anemia coexisted, perhaps had preceded it. The ages ranged from 5 to 22 years, with preponderance of the period from 8 to 15 years.

All of these patients complained of ocular discomfort, described sometimes as a burning or, rather oftener, as an ache, and usually accompanied by more or less headache. While reading intensified the discomfort, most patients complained more or less even while resting the eyes, and indeed very commonly much discomfort was noticed at once on rising in the morning. Perhaps this was due to the effect of daylight on the eye sensitized by darkness; for as a rule, these patients were annoyed by strong light of any kind.

No indication was found that the pigment changes affect the acuity of sight. While perhaps a large number of the patients had less than perfect vision, there seemed to be no relation between the lowered vision and the amount of stippling, either in the periphery

2. Loring: Text-Book of Ophthalmology, i, 50.

or in the macular region. In no case was there any history of gradual failure of sight. Among the forty patients (after the correction of all ametropia), vision was 20/20 or over in 10; 20/20 to 20/25 in 12; 20/20 to 20/30 in 12; under 20/30 in 3, and under 20/30 only in one eye in 3.

In no case was there any intra-ocular lesion found to account for the lowered vision. In most instances, the presumable cause must have been irregular astigmatism. Of the three patients with vision under 20/30, one had myopia of 3.5 D.; in the other two no cause could be found. In the three instances of one-sided poor sight, the condition seemed analogous to the not infrequent amblyopia found in an eye slightly more ametropic than its fellow.

The refraction in the forty patients was: emmetropia in 9; H or As under 1 D. in 24; Hs or As over 1 D. in 3; M under 3.5 D. in 4.

Very few so-called muscular anomalies were found. Not one of these patients had hyperphoria and none of them esophoria over 1 degree, or exophoria over 8 degrees. In thirty of them, the converging power was normal, in 10 slightly reduced.

The asthenopia was, of course, not of refractive origin in the ametrophic patients, while complete failure to relieve by glasses proved that in fourteen of the cases with low degree of H or As, the complaints were likewise not dependent on the ametropia present. In nine others correction of the error proved of some benefit, by allowing them to use their eyes with less discomfort, but could not be said to have given complete relief. In only four (three of these had errors of above 1 D.) were all complaints stopped by glasses as long as they were worn. Yet, even these cases do not come under the head of ordinary asthenopia due to refractive errors, since their complaints, though really dependent on the ametropia, were so decidedly more intense than we find to be the case in ametropes in good health. I have therefore come to the conclusion that in most of these patients the ametropia was only a complicating factor and generally one of minor importance.

The pigmentary changes are not necessarily of a permanent nature. I judge so by the fact that I have scarcely ever seen a pronounced granular appearance in the healthy fundus of people much over 20 years of age, even when suffering from neurasthenic asthenopia of long duration. Furthermore, I have watched the fundus a number of times during months and once for several years in patients with patches of localized chorioiditis or chorioretinitis, and have observed that the stippling surrounding the foci can change or even wholly disappear after the disease has come to a standstill. Six of the juvenile asthenopes in this series of 40 I have been able

to see for many months, and two of these I reexamined after the lapse of one and one-half and six years. In all of these the pigmentary stippling seemed to have diminished to a variable extent. In the one seen after six years it had disappeared entirely, but I must add that in this one it has never been very striking.

The treatment of these patients consisted principally in relative rest of the eyes and general hygienic measures. While abstinence from eye-work proved of benefit in most instances, it alone was not fully curative. Indeed, some of the children were brought to me on account of the persistence of their discomfort during school vacation. In some instances the temporary relief from the use of smoked glasses was very striking, more so than I have ever seen in any other form of functional disturbance of the eyes. In all cases in which the correction of any existing ametropia gave relief, even if only partial, the glasses were continued while under observation. For ultimate success, however, I trusted to measures directed against the neurotic condition—liberal outdoor exercise, sojourn in the country, bathing, correction of habits and diet, iron if required, and sometimes strychnia. About one-third of the patients lost their eye complaints and headaches under this treatment; another third were improved to a variable extent, while the balance could not be watched a sufficiently long time to be recorded regarding the final outcome.

The exact significance of the pigmentary changes described is not made plain by the observations. It must not be forgotten that cases of very similar clinical history but with homogeneous fundus are not uncommon. On the other hand, the frequent association of stippling and granular appearance with this exaggerated asthenopia of young subjects and its rare appearance in eyes without complaint, suggest a definite relationship. It does not seem possible to me that the changes in the pigment epithelium are the direct cause of the asthenopia, yet they presumably contribute to make the eyes more sensitive. The occurrence of similar changes in these cells around the chorioidal foci suggest that they may result from nutritive or circulatory disturbances in the chorioid. What rôle such disturbances play in asthenopia of the type described we do not know. At any rate, the greater prominence which the pigmentary changes present in markedly neurotic subjects raises the question whether instability of the central nervous system may not reveal itself by the liability of the retinal pigment epithelium to undergo structural changes. For these cells, like the retina proper, are embryologically a part of the brain.

DISCUSSION

DR. H. GRADLE, Chicago: As the hour is late, I would like to say that this is a paper written by my father, I cannot say how long ago. I discovered it in some old papers after his death. From the condition of the paper and from the literature that he quotes, it must have been about ten years go. I have never been able to find a trace of this being published any place, and therefore I have brought it out.

DR. LICHTENBERG: I move this be read by title and published in the Transactions. Seconded and carried.

SOME SCIENTIFIC ASPECTS OF INOCULATION THERAPY AND THE RELATIONS OF IMMUNITY SO INDUCED TO THAT SPONTANEOUSLY ACQUIRED

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True specialism must be something apart from localism, and the specialist must never become a localist. When he loses sight of the body appended to his elected site he becomes a menace to progress.

Infections are generally local. There are few exceptions to this, so also the resistance to infection has at least its inception *in loco* and the old theory of *locus minoris resistentiae* is to-day tenable, has a scientific basis and is demonstrable. We also find in the evidences of auto-intoxication, on the one hand, and antibody formation, on the other, scientific proof of the old theories of humeral pathology.

When Mithridates, in the century before Christ, undertook to toughen himself against the poisoned arrows of the enemies of his people by gradually increasing doses of the arrow's poison, he but applied empirically the principles of immunization as studied to-day.

The problem confronting us in our field of endeavor may, with profit, be studied from a viewpoint made possible by the evolution of latter-day research; and what we have to offer may within limit be applied to other fields of specialism, being subject only to the regional variations, the variations in sensitiveness to invasion by specific micro-organisms.

The eye is peculiarly liable to certain types of exogenous infection, as by gonococcus and other organisms—types to which the nose and throat are largely immune. On the other hand, the diphtheria types are largely innocuous on the conjunctiva, as is also the skin type of staphylococcus; whereas at least one strain of diphtheroid, discovered by Cautley and to which we gave the name of *Bacillus segmentosus,* was shown to be the only organism present in some 33 per cent. of the cases of acute rhinitis studied and reported by me at the American Medical Association meeting in 1910; and while the staphylococcus—particularly the hemolyzing strains—probably causes a proportion, perhaps 5 per cent., of cases

of acute rhinitis, and while the *Staphylococcus aureus* will cause furuncles at the atrium nasi and the common stye in the tarsal conjunctiva, all are probably largely saprophytic when found in diseases of the mucosa of the nose or its adnexa.

When this report was made (the study covers about 400 cases of rhinitis, of which 100 were tabulated), we felt that the foundations for prophylactic inoculation, the prevention of common cold, could be laid. However, it is necessary to report that since 1910, when this study was made, the then predominant bacteria, namely, the *Bacillus segmentosus* has not been encountered at all and the *B. catarrhalis* but a few times, and in their stead has come the wave of streptococcus infections which has swept this country during three years and which appeared in London in August, 1912, where we isolated the organism in several cases which came under observation there.[1]

This streptococcus strain will grow upon the conjunctiva in some measure, in the nose strongly, markedly in the pharynx, in the trachea persistently, and in the ear with increasing virulence, as we all know, and also in the blood-stream. Its virulence is exalted on the meninges. *Streptococcus pneumoniae* has often been encountered as a localized circumscribed atypical type. These subjects are susceptible to reinfection and this sensitization is slightly general but markedly local, a "sensation of the area," such as we called attention to in a paper before the American Medical Association this year. Once involved, the area will light up again on infection and may even be irritated by vaccines of homologous strains. Clinical examples of this are shown also in joint involvement and in iritis of this type, so prone to recur. We see this also in the eye in pneumococcus corneal ulcerations, which come back to us so repeatedly.

This local sensitization is a point to which more attention should be given, as it explains so much and leads the way to a prophylactic régime. On this point I would ask you to note that tissues in conditions of vascular stasis, as the tarsal border under prolonged refractive strain, and tissues of low vitality, as adenoid types, are particularly liable, *after once being infected,* to show recurrences because sensitized; and our problem here is probably not so much

1. Into the reason for this variation in infectors in different years it is not possible to enter. Flexner believes that the streptococcus undergoes an exaltation in virulence in milk, and thus gives reason for the epidemics that have been so prevalent with us and so severe. This streptococcus appears in chain formation after a few days' growth and appears in extensions into sinuses and into the ear, and is beyond question the cause of most of the severe types of infection encountered during the past few years. These have been and continue to be diagnosed as la grippe, but I have still, as I at that time reported, to note the entire absence of the influenza bacillus in culture or smear from these cases.

one of general as of local resistance. The adenoid type of tissue constituting the Waldeyer ring, while probably a strong wall of defense against the absorption of poison and infection by bacteria, when once infected, particularly by the streptococcus group, becomes more sensitive to reinfection and thus a menace to health.

After a few infections of this recurrent type, I am sure one may note that at least a relative immunity is attained, and these are the cases where our forefather physicians were right when they said "these patients will outgrow the tendency to cold"; they do, and by an established immunity not possible by the single attack such as ensues on scarlet or typhoid and the like. I believe we may observe this with a little care and that it is a point of value that this increased sensitiveness is a part of the streptococcus immunization, and that several repetitions are necessary for its evolution into genuine immunity.

In offering some explanation of these peculiar epidemic waves, we might, in addition to what Flexner says about increasing fastness or virulence of organisms due to conditions of growth, call attention to the variation in immunity produced by the various types of infectors. The diphtheroid, catarrhalis and typhoid groups generate, like the variola and scarlet-fever infections and possibly the influenza, an immunity lasting quite a considerable period; whereas the pyogenic cocci, including the pneumococcus and the various forms of streptococcus, produce but a brief immunity and are followed by increased sensitization.

We see, then, that at least two factors make difficult the prophylactic exhibition of vaccines in our field—the great variation in infectors, both as to kind and as to aggressivity in different years or in different seasons;[2] and secondly, the probable variation in the length of immunity after infection by the various organisms and the increasing sensitiveness to the streptococcus groups, including the pneumococcus, after reinfection.[3]

From these observations we may at once realize that the problems of inoculation therapy must also be complex. No cure-all method has here been vouchsafed.

May we first, then, to avoid empiricism, study a little more carefully the natural methods of cure of infection before we apply the principles to our chosen field?

It may safely be said, however much we may laud ourselves for our accomplishments in combating infection, that we do no

2. Vide the finding of *Bacillus segmentosus* only in autumn epidemics.

3. This latter factor has to be considered, too, in the exhibition of vaccines of this group, since in lieu of immunity the possibility of increasing the sensitiveness cannot be gainsaid.

more by usual drug methods than render the subject more comfortable pending the evolution of the protective substances. Nor are the responses of the body easy of analysis, for they probably cover a much wider range than is even now our conception. It is presumptive to assume that any method of therapy is adequate either for all infections or always for the same infection. They may, however, have similar basic principles. Simon is probably right when he says: "So much, however, seems certain—that nature's ways, so far as we have become familiar with them, are the only specific ways along which progress seems possible, and that drug treatment if it ever shall become of value must start from a different basis, and that basis must be a knowledge of the principles which underlie the interaction between the disease-producing agent and the affected organism." So we may justly conclude that inoculation therapy will be valuable in proportion to our understanding and our adaptation of this understanding of the *natural* methods employed by the body in the cure of disease.

Studies in immunology have brought out the fact that the body response to infection varies according to the infector. In this we are not referring to the action of the leukocytes directly, but rather to the substances in the nature of antitoxins, antibodies and lysins which come from not entirely understood functions of the body-cells. We know that probably in phagocytosis we have the greatest defense, that is, the defense applicable to most infections; but it is certain that phagocytosis fails in many cases and with many organisms, and possibly at times with all organisms. Something else is always necessary to produce phagocytosis, even in the presence of increased leukocytes. We know that agglutinins are particularly active in the typhoid group, that precipitins are put forth in response to certain types of albuminous substances parenterally exhibited, that cytolysins or solvents of cells are evolved from certain cellular toxins as is possible in sympathetic ophthalmia, if we accept the theory which Elschnig put before us at the last meeting (1912), though one observes, in other terms than this.

Then we have the bacteriolysins or pure solvents of bacteria, ferments probably contained in the white cells themselves; and finally, most important of all, because most general, the opsonins, substances which activate by their presence the otherwise latent leukocytes. Then we have the more or less well-known antitoxins, which are formed in response to inoculation, in large quantities by the so-called exotoxic group of bacteria. We know that the chief example of bacterium which operates by its excretion or secretion, and is hence purely exotoxic, is the diphtheria organism; and, we

know that while the *Bacillus diphtheriae* is very mildly infectious, its toxin is extremely virulent; whereas other organisms, the endotoxic types which have to be broken up in order to produce their toxic effects, are relatively more infectious and less toxic. These extreme types tell us again that there must be every variety of response to meet the various types of infectors. There is no strictly bacterial nor strictly antitoxic immunity; either would be inadequate to the exclusion of the other. Hence, even the mildly toxic organisms produce some antitoxin in addition to other antibodies, and that the diphtheria organism produces other antibodies than antitoxin though in milder measure. Hence, at once appears the great value of sera containing diphtheria antitoxin to neutralize these extremely toxic substances, and the relatively little antitoxic effect of antisera of the more purely endotoxic organisms.

Another point in reference to antibody formation is the more than probable fact that natural immunity varies with different periods of life. It was long ago shown by Wells, for instance, that opsonins are absent in infancy, and yet infants are singularly free from infection of the nose and throat, at least for the usual organisms of endotoxic type.[4] The liability of girls at puberty to tuberculosis, of youth and middle age to typhoid and of youth to acne, are demonstrations of this.

Knowing more of the natural methods of antibody formation, the body response to invasion, the possibilities of the application of such inoculation therapy become greater, though still far from simple. Several possibilities obtain from the immunity side:

1. Prophylactic inoculation. To employ this we must know in advance the nature of the infector, and we must have an homologous strain for the making of the vaccine. In view of our study of the infectors and their great seasonal variation, we may hope for no better plan than, by a study of the prevailing epidemic, to provide ourselves with fresh stock vaccine made from several current cases; and in closely associated groups of individuals in schools or institutes or in families, to prevent the spread of the infection by inoculation with the initial strain. This we do in practice and with seemingly good results. We must bear in mind, however, the relatively short duration of the protection from the streptococcus group compared with that following typhoid, which latter continues for several years as against a few weeks perhaps for the former.

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4. I believe we have a perfect explanation of this fact in the underdeveloped condition of the afferent nerve fiber and the vasomotor control. To this there is not time here to give attention, but we hope some day to present both theories and proof along this line as part of a general régime of prophylaxis in relation to these infections.

2. By knowing the tendency of an individual to develop a known infection at season, he may be protected by his own strain of vaccine carried over from the previous attack. In this, as in all therapy of this type, only small dosage is advocated, on the general basis that sensitization or increased liability to infection, or negative phases of immunity instead of the expected protection, will ensue from large doses in at least a considerable number of cases. The small dose not only has not this possibility, but does all that the large dose will do when it brings forth the desired response of antibody formation. This practice has therefore at least the element of safety.

3. We may after the incidence of the attack shorten its duration, diminish its severity or prevent its extension.

I am not in harmony with the observers of this therapy who refrain from its exhibition in acute infections. Originally, Wright withheld the therapy because of his belief that the body was already being provided with such quantities of autogenic vaccines (auto-inoculation) as to make it unsafe as well as unreliable to add to them, but clinical observation early compelled him to change his practice. We have never hesitated to employ the therapy in acute cases, and we believe that the attacks are much shortened, even occasionally aborted. Vaccines certainly tend to protect the body against extension through the blood by raising its bacteriotropic pressure or volume of antibodies in the blood-stream, and there is certainly an advantage in the reaction which takes place at a site of inoculation away from the infection focus.

We may fail entirely to accomplish our ends in influencing in any way the infection, and particularly in streptococcus groups and where there has been no preinfection our problem is difficult. This has happened in two striking cases of "sterilized" children—children who have been so guarded that they have never had any infections. These went slowly to fatal issues despite all therapy, including the autogenous vaccines early exhibited and carefully administered under opsonic control. In these cases the streptococcus develops a fastness which renders it invulnerable to antibody attack. The organisms seem to be protected by capsule formation. This is a fine example of what Professor Welch has claimed we must bear in mind, that the micro-organism has its form of defense as well as the body. They will develop this in animal passage, whereas in growth upon ordinary culture media they will lose the capsule and with it their aggressivity.[5]

5. This is a matter of considerable importance with reference to the opsonic index in these cases, where it must be borne in mind we are testing the resistance of a body to a diminishing virulence of laboratory growth.

In other cases where smears show the bacteria lying outside of the leukocytes indicating lack of phagocytosis, and without capsules, we know that a negative chemotaxis has been brought about. Toxins generated locally seem to increase this. Raising the opsonic index by inoculation therapy will often convert this into positive chemotaxis and the bacteria will later be found within the cells and undergoing phagocytosis.

4. We may mention the cases where there is a "truce" between the infector and the infected. What we have presumed to call a "defensive equilibrium" is attained. This is true in many cases of chronic tonsil inflammation. The body has its protection and so has the organism, as in innumerable cases of tuberculous foci throughout the body, in sinusitis and in chronic infections generally. Inoculation therapy, by increasing the bodily defense, will not only furnish protection against further extension or metastases, but in some cases will distinctly aid in the cure.

5. In preoperative inoculation the results are brilliant, as healing is accelerated and often immediate, while at the same time the body is protected against invasion. This practice is distinctly worthy of commendation.

It has been a question whether antibodies circulating in the blood-stream would find their way into corneal, conjunctival and other ocular tissues. It would, *a priori*, seem unreasonable to find such were not the case. Loeffler first established it as a fact that the cornea partakes in the immunity of the rest of the body. Roemer and his assistant, Grueter, probed it beyond question, and continuously employ it as a principle underlying their therapy. The colloidal nature of these antibodies, however, makes their action more difficult in corneal infections because they do not penetrate so readily tissues of this type.

With reference to the circulation of immune bodies through the ocular tissue as offering clinical evidence of the claims, attention should be called to the relative infrequency of purulent ophthalmia in persons suffering from gonorrhea. The ratio of such secondary infection is so small, while the opportunity for ocular infection is so ever present, that we have a right to think that it is the general immunity which protects the uninfected tissues. Often we pride ourselves on preventing the development of the infection in the second eye. Is it not possible that the raising of the general immunity from auto-inoculation from the first eye does more than we do to prevent this secondary infection? If this is so, it would be indicated to employ the inoculation therapy early in all these cases, and in associated individuals for their protection.

Observation of the opsonic index in several hundred cases seems to show that in only a limited number of malignant cases is the general bacteriotropic pressure below normal; the blood usually contains sufficient resistance to infection. This makes us think that the theory of low local resistance must be called to account for the primary invasion.

There are many difficulties in isolating the causal organism in a given case, even when cultures are available. Experience seems to teach that in acute cases it is the predominant one shown in smears. This applies particularly to acute sinus and middle-ear infections. Many times where several organisms appear one must judge symptomatically. In chronic cases saprophytic and secondary infections cloud the judgment. Plating out is the only reliable method in these cases. In iritis and iridocyclitis, and some forms of scleritis and the deeper infections, the difficulty is further enhanced by the lack of direct culture. Here we must and may fall back on an immunity reaction, the complement-fixation test, provided we have some clue to the type and strain of the infector. In a few cases we have applied this test with success and with brilliant results, and in some we have met with failure; but the successful cases demonstrate the value and the failures only the shortcomings of the method.

Mixed vaccines, to be of value, must be made by growing the organisms separately, certainly not together; for in the latter case there is much variation in the growth, some being inhibited by symbiosis, while others are accelerated.

One may say, then, that inoculation therapy raises the bacteriotropic pressure of the blood. Only in so far as this increased pressure in the form of antibodies may be carried to the point of infection and be brought into direct influence on it, may we expect results. In our field, aside from the diphtheria, we encounter the endotoxic organisms almost entirely—types to which the antibacterial immunity is the mode of defense. This latter immunity consists, as we have seen, in the evolution of antibodies of the lytic and opsonic types. These aid in the destruction of the bacteria, both by their binding and dissolving characteristics. Their cooperation with the leukocytes in the production of phagocytosis is well known. Therefore, it would seem reasonable to apply sera containing these antibodies directly to the lesion where it is open and exposed. The antipneumococcus serum has served well in my hands for direct application to pneumococcus corneal ulcers and mucous membrane infections, and appeals to one as being quite as effective and free from the dangers of the circuitous blood-route. The anti-

staphylococcus, the antipyocyaneous, the antistreptococcus and other sera will be found of advantage in suppurative sinus and aural conditions due to their respective organisms.

When we have the causal organism and our vaccines, we are still far short of success, since these, as we have said, but raise the bacteriotropic pressure (the general resistance). We still have the problem of volume and interval of dose which are essential prerequisites of success, and we still have to determine the flow of these substances through the area for ideal results.

It is the ratio of specific antibody formation to the circulation of the area which determines the incidence of the attack.

In the early stages of acute infection the antibodies are walled off by this stasis, but if we have an adequate bacteriotropic pressure in the blood-stream, the disease may be aborted by quickly determining the flow of blood through the area. This may be done by measures productive of hyperemia—active, as by extreme heat or cold (both of which act much the same), by stimulating medicaments, by violet Roentgen-rays; or by passive hyperemia, as by negative pressure, or by Bier's bandage. Contact between antibodies and the attacked area is retarded or inhibited in abscess formation and drainage must be employed to restore their flow. The great fatality of meningitis is due to the inability to get the antibodies in contact with the infectors and the action is akin to abscess formation. However, even in severe cases if their pressure is high in volume, they will abort or cure; if low, they will fail and the tissues will be further invaded, and nothing but the wall of secondary defense which the tissues throw out will prevent their progress; and they, in their turn, further tend to prevent contact between the antibodies and the infector. I believe that advocates of negative pressure as applied by suction apparatus in ear, nose and throat, have failed of the mark in their advocacy of this therapy for aspiration purposes. They aid some by this means, but their main value consists in the increased flow of blood through the area which they generate. Iodin aids by stimulating lymph-flow. A Bier bandage accomplishes similar results, and this is further aided by sodium citrate and citric acid solutions.

So we find ourselves traveling in a therapeutic circle and coming back to the point of beginning, namely, the area of low resistance, the area of sensitization and the area of stasis. If this circle is to enclose and isolate infection, it must have no weak segments. Nothing should be neglected. Details are imperative, and we cannot with a wave of the hand cast aside all the therapy of our experience for a new method. We must call to our aid as much of the old

therapy as is consistent with the new thought. We must employ all the usual therapeutic measures which tend to bring out the autogenic defense.

We have had shown us a way to induce natural immunity, whereby the duration and intensity of the disease may be shortened or the infection aborted and perhaps prevented. This induced immunity is, even with our limited knowledge, in many way superior to that spontaneously acquired—particularly in the vital elements of *time* and of *safety*. All other measures are as essential as ever, and the greatest of these is the normalizing of the areas of the body most subject to infection, that is, areas of low resistance, whether by correction of eye-strain in recurring ocular infections, the normalizing of nasal malformations, or the removal of infected foci in nasal, post nasal, or pharyngeal spaces or mastoid bone. Along this line specialists in all branches have done valiant service and have been the means of real progress.

DISCUSSION

DR. S. H. LARGE, Cleveland: I wish to congratulate Dr. Walter on his scientific paper. In Cleveland for the past year we have been trying to find out something for colds. We have a bacteriologist in our office who has made an examination of nearly every case that has come in. The point Dr. Walter brought was very interesting, that is, to find the microorganism in which the patient's resistance is low. We found the staphylococcus most frequent and the influenza bacilli next.

It is a good idea to keep the old vaccine on hand, and when the patient comes with another cold, and you can find the culture to be the same microorganism, you can begin the autogenous vaccine immediately. This makes the duration much shorter than otherwise. In sore throats streptococcus was the predominant microorganism.

We had an epidemic of diphtheria in one of our institutions and a culture was made of all the throats. Eight diphtheria carriers were found. Antitoxin has no effect on these cases even in large doses. The staphylococcus spray and lactic acid were found to have no effect on the diphtheria bacillus, as they returned in a few days after treatment.

The theory of immunization is graphically described by Ehrlich. He takes the cell and shows it in this way in a rough sketch (illustrating); then he takes his antibody and shapes it this way (illustrating). He says that immunization takes place by interlocking of the antibodies with the microorganism by the complements. There are at least ten different theories at present as to immunization.

In the empyema of the sinuses you must first get drainage and then the use of the vaccines is certainly beneficial. I would like to cite a case referred to us of multiple infection—otitis media, infection of the antri, ethmoids and frontal sinus. We did a paracentesis, removed anterior ends of either middle turbinates (washed out antri) and made an autogenous vaccine of the staphylococcus. After the fifth injection all discharges had ceased. In about four months, I saw him again and he had a subacute otitis media and infection of the left antrum and ethmoid cells, following a severe cold. The vaccine was again given and at present all conditions have cleared up, except the right ethmoid. Drainage is the most important. The stock vaccines have been of no value in our hands.

Dr. W. Reber, Philadelphia: Like Dr. Large, I feel it a duty to congratulate Dr. Walter for bringing this subject before the Academy. We have many papers on anatomy and physiology and innumerable instruments, but here is one along the line of therapeutics.

My first case was a woman who was declined operation for cataract because her conjunctivae were not at any time bacteriologically negative; enormous quantities of staphylococci could be recovered from her conjunctiva. After careful bacteriological study for from eight to ten weeks, I said to her son: "This lady must take her chance some time; you must decide whether she shall stay in darkness or take that chance." I proposed that she should have staphylococcus vaccine sixty hours before operation, and then if the eye was not quiet, about the third day after the operation, she should have more staphylococcus vaccine. She did nicely until the fourth day, when I saw the beginning edema at the inner corner of the upper lid, which is always the herald of an intraocular infection. She was given three hundred million *Staphylococcus aureus*. The next day she was much better but the following day not so well, and I then put in three hundred million more. She reacted nicely and was saved a severe postoperative infection and has a satisfactory result.

The second case was one which most surgeons would have settled by an excision of the lachrimal sac, but this was absolutely refused. She was told that she would be very much better off but that she would have a deformity. In this case it was a staphylococcus albus, and she has had some twelve or fifteen treatments with staphylococcus vaccine and is practically without any disturbance at all. This case is recent and open to discussion.

The third case I wish to propose for your consideration is one of the most obscure cases I have studied for many years. It concerns a little, undersized woman, with chronic bilateral uveitis. In spite of a negative Wassermann, repeated examinations by the rhinologist which were negative, and negative Pirquet, she was mercurialized and she had tuberculin but without any result. A swollen knee-joint was tapped and the culture was negative. We found she had a strange perversion of metabolism and she was empirically placed on thyroid, which aggravated her condition. Her tonsils were scraped and the culture showed a large hemolytic streptococcus, from which a vaccine was made, and she has shown much improvement under this treatment.

Dr. Kate Wylie Baldwin, Philadelphia: I have just one word to say in connection with the violet ray and ozone as a treatment of the septic condition where the paper speaks of using vaccines. I hope to bring your attention to it to such an extent that all will try it before next year's meeting.

Dr. Joseph Beck, Chicago: Dr. Walter's paper is of extreme importance and interest, and I hope that there will be a large discussion because it is not new. Many of us have used vaccines and have observed our cases, and here it is where we ought to confess our observations and perhaps learn where we are wrong. Why is it I cannot have these results you speak of in using the autogenous vaccines? I cannot subscribe to these results as given to us. Three years ago I presented a paper on this and enthusiastically and prematurely reported results. It depends on the pathological condition present.

Dr. Large's remarks are clear as to the acute class, but taking the chronic, which implies to me the change in tissues, some cases absolutely will not respond to the injections of autogenous vaccines. It certainly requires some other means of clearing this point to my satisfaction.

In Dr. Reber's case, scraping of the tonsillar crypt showed streptococci, and the antitoxin is helping his case. Mere scraping of the tonsils will help these ocular conditions, but the tonsils remain and the trouble continues. In iritis or other infections, perhaps it is the tonsil, the sinus, the ear or the teeth, and then I am through so far as I am concerned; but this patient must have the proper condition of the intestine, of the uterus, the prostate, the gall-bladder, the appendix and of the skin. These are peripheral pockets and it should be our business to watch out for these, and not be taken in by saying that removal of the tonsils will cause rheumatism to disappear. I have been deceived. It is the same with vaccination, and I am not too ready to give in to this remedy.

DR. S. D. RISLEY, Philadelphia: I have been deeply interested and instructed by Dr. Walter's paper and Dr. Beck's remarks. I have seen very striking results from the mode of treatment set forth in the paper, but have met with many disappointments. One reason, perhaps, for our frequent disappointment can be found in the fact that while the introduction of a vaccine, antitoxin or tuberculin might arrest or cure existing disease, it could not be expected to remove the sequelae of the disease. To remove the thickened tissues and infiltrations resulting from possibly long-standing infections or toxemia, the slower processes of Nature are required.

DR. WILL WALTER (closing discussion): In answer to Dr. Reber's question, I will say that I use a pneumococcus serum directly on the corneal ulcer with a swab after cleansing. I endeavored to make it plain that we were dealing with a subject from a broad viewpoint, and that we are not making claims for vaccine therapy as such. We must remember that there is a natural immunity. We are all safer when we take good care of ourselves, live in a favorable climate, breathe deeply and give attention to our excretions; there is a natural immunity that goes with good living. Calomel will also raise resistance and good results follow its use in absorbing doses. The cases of which Dr. Risley speaks may be called sequelae, but they are sensitized areas, in the first place, hence more liable to infection. Changes have taken place in them which make difficult the circulation of antibodies through them. I think the violet ray and ozone may not be said to kill organisms in the tissues directly in therapeutic application. Like the Roentgen ray, they increase the local opsonic index and stimulate the antibody formation. Inoculation therapy is only a part of the therapy which we must all employ if we are to finally beat infection; but it must be founded on an understanding of the natural methods of immunity.

A FURTHER REPORT ON PARINAUD'S CONJUNCTIVITIS

REPORTS OF NEW CASES WITH MICROSCOPIC FINDINGS

GEORGE F. KEIPER, A.M., M.D.
LAFAYETTE, IND.

At the Cincinnati meeting of the American Academy of Opthalmology and Oto-Laryngology, in 1910, I reported a case of Parinaud's conjunctivitis, and made it the basis of a review of the literature of that rare disease up to that time, appending thereto a complete bibliography of the subject embracing sixty-six reports.

Since that time a number of new cases in forty new reports have been recorded, and it has fallen to my lot to have seen two more cases of the disease and to have excised the granulation in one and a microscopic examination made of the same.

The disease is evidently very rare. In a recent visit to Vienna, in both the Dimmer and Fuchs clinics in the Allgemeines Krankenhaus, those in charge informed me that they had never seen a case of Parinaud's conjunctivitis.

Etiology.—The question as to its etiology remains as obscure as ever, save for what is to be reported in this paper. It will be remembered that Parinaud believed it to be due to contact with animals, especially of the bovine type. Up to 1910 this view was much disputed. In one of my recent cases there was no opportunity for such contact, while in the other there was, though a careful inspection of the animals on the place with the able assistance of Prof. Robert A. Craig, head of the Department of Veterinary Science of Purdue University of Lafayette, failed to reveal anything on the animals as to a probable cause along this line. Pechin[1] reported a case in which a dog was supposed to be the cause of infection. Parasotti[2] reports two cases of this disease. In one, the disease showed itself after an infection from a scraping of uterine carcinoma. Suda[3] reports a case in which the infection was supposed to be due to a cat.

All cases so far observed have been in the Caucasian race save the one reported by Krauss and Boyle,[4] which occurred in a negro child.

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1. Pechin: Soc. d'Ophth. d. Paris, 1910, p. 29.
2. Parasotti: Ann. d'Ocul., clxiii, 143.
3. Suda: Nippon Gankakai Zachi, June, 1910.
4. Krauss and Boyle: Ann. of Ophth., xix, 52.

Symptomatology.—The patient's appearance is quite characteristic. The disease is always unilateral. But one report exists as to a bilateral case. The eyelids are swollen and heavy. On eversion of the lids, the conjunctiva of the upper is found to be the seat of a large granulation, sometimes involving the entire conjunctival surface. The granulation is pedunculated as a rule.

At times the ocular conjunctiva may be chemotic. Indeed, so much so as to completely hide the cornea, as in an extreme case reported by Pechin.[1] Two of my own cases showed this marked chemosis.

There is usually but little discharge from between the swollen eyelids.

The concurrent adenopathy, embracing all of the lateral glands of that side of the face and some of the adjacent glands of the neck, is also characteristic; and this, together with the condition of the eye, makes up the main symptomatology of Parinaud's conjunctivitis.

The glands become quite large at times, and it seems as if suppuration were to ensue. But when punctured no pus is found or if present, in but very small quantities. With the subsidence of the eye trouble the glands again become normal. The temperature is but slightly elevated, rarely going over 100. Otherwise the patient appears normal.

Pathological Anatomy.—The gross changes are those enumerated under the head of symptomatology above.

As to the histology, different writers disagree. For example, Verhoeff and Derby[5] found the lesion to consist of an infiltration made up of phagocytic and lymphoid cells with marked cellular necrosis. Parasotti[2] reports in one of his cases that the excised tissue showed "epithelial hypertrophy and necrosis, principally plasma cells which surrounded and in places penetrated the blood-vessels, which caused the author to think that they were in part white blood-cells." In one of my cases I excised the granulation and submitted it to Prof. H. R. Alburger of the Department of Pathology of the University of Indiana who reports as follows:

"In only a small portion of the sections in the series is the surface epithelium seen, and then it is somewhat thickened, the cells are swollen, in some instances vacuolated and without nuclei.

"Beneath the surface we find a highly cellular tissue made up of a reticulated framework containing many cells and capillaries. The framework is partly of old connective tissue (relatively old, that is, in that the tissue is more fibrous than cellular), the fibers of which show marked evidence of hyaline degeneration, and partly

5. Verhoeff and Derby: Arch. of Ophth., July, 1904.

of actively growing, newly formed connective tissue made up principally of spindle cells and very delicate fibers. All of this tissue is very loosely arranged, the fibers crossing each other rather than lying parallel. The intercellular as well as the interfibrous spaces are large, as though the tissue were edematous. The blood-vessels are not so conspicuous as in ordinary granulation tissue, but are empty and for the most part characterized by a wall of two or more layers of plump endothelial cells, also suggestive of cloudy swelling and edema. The cellular elements of the interstitial tissue are small round cells of the type of lymphocytes, having scanty protoplasm and a deeply stained nucleus, usually round or oval, occasionally lobate. A few plasma cells are seen, but practically no polymorphonuclear leukocytes.

"In one large area we find a different picture. Here the tissue is dense and the connective tissue more cellular, while there are seen a large number of deeply stained filaments lying parallel and crossing each other at acute angles."

Rosenbach[6] reports four cases of this disease, of which two were chronic tuberculosis of the conjunctiva, corroborated by histologic examination, experiments on animals and biologic reaction.

Stern[7] regards the disease as a form of attenuated tuberculosis of the conjunctiva. Implantation experiments were successful after preliminary iridectomy. The disease healed rapidly under tuberculin.

Meisner[8] also regards it as tubercular in origin.

Krusius and Clausen,[9] in reporting two cases of this disease, sum up their experience as follows: "From the present and experimental view of the genesis of the human phlyctenule, it can be taken for granted that it is not itself tuberculous, but it is a local reaction to various specific injuries to the eye in a body which has been previously infected by tuberculosis." Transplantation experiments in both their cases failed to show tuberculosis.

Cassell[10] reported a case wherein the von Pirquet and Wassermann tests were negative. A culture was also negative.

Bacteriologically nothing characteristic has, up to date, been found save by Moeller,[11] who reports that he obtained pure cultures of human tubercle bacilli from his cases, and the findings of Drs. Warthin, Novy and myself, where cocci seem to be its cause. In the *Archives of Ophthalmology* for July, Verhoeff of Boston

6. Rosenbach: Arch. f. Augenheilk., lxxii, 162.
7. Stern: Centralbl. f. Augenheilk., xxxvi, 321.
8. Meisner: Ztschr. f. Augenheilk., xxvii, 127.
9. Krusius and Clausen: Arch. of Ophthal., xliii, 165.
10. Cassell: Arch. f. Ophthal., xii, 29.
11. Moeller: Deutsch. Med. Wchnschr., 1912, No. 44.

describes a hitherto undiscovered organism that may be the cause of the disease. He found it in eleven of his own cases. It is a fungus formation. Alburger thought that he saw practically the same in my own sections, but Verhoeff could not find them, neither could Warthin and Novy of the University of Michigan. The latter found numerous cocci in the section which neither Verhoeff nor Alburger found. Even in those cases which seem to be tubercular in origin and character and which produced lesions in animals after transplantation of affected tissue, no tubercle bacilli have been found by others. Neither has the characteristic histologic tubercular tissue been found.

In the other two of Rosenbach's four cases noted above, one case was due to the pneumococcus (Fraenkel-Weichselbaum) and the other was a chronic trachomatous process with secondary infection due to Koch-Weeks bacillus.

We may find in investigation of future cases that the disease that we now call Parinaud's conjunctivitis may be resolved into several distinct types as the result of histologic and biologic examination.

Diagnosis.—The syndrome of symptoms, the unilateral swelling of the eyelids and of the glands of the face and adjacent neck, together with the peculiar granulations of the palpebral conjunctiva and moderate rise of temperature, makes the diagnosis easy. No other disease presents such an array of symptoms.

Prognosis.—All patients to date have recovered with no damage to vision. No recurrences are reported. The reports indicate that it takes from two to six months to effect a cure, and Vada[12] reports an extreme case wherein it took eighteen months to effect a cure. In all my own cases cures were effected in less than five weeks.

Treatment.—Since some reports seem to show a tubercular origin, tuberculin has been added to the list of remedies for the cure of the disease. In all my own cases I made daily applications of a 2 per cent solution of nitrate of silver to the everted eyelids. The patient was given the following prescription for home use:

℞ Zinc Phenolsulphonate .....gr.j
Acid. Boric .....gr.x
Aq. Dest. .....℥ j
M. Sig.: Drop 2 drops into the eye every hour.

The patient is also instructed to bathe the eye every hour for five to ten minutes with water as hot as the back of the hand will stand. To the enlarged glands dry heat continuously applied seems to be very agreeable. Internally, calomel is given to thoroughly

12. Vadja: Ztschr. f. Augenheilk., xxiv, 532.

clean out and sterilize the bowels. Also quinin to combat the moderate fever.

Where possible the granulations had better be excised and submitted to microscopic examination.

CASE REPORTS

CASE 1.—Rachel P., schoolgirl, aged 10, was referred to me Sept. 18, 1912, by her physician, Dr. J. N. Shafer, of this city.

Case 1.—Shows the edematous eyelids, the adenopathy of the left side of the face.

Fifteen days before she and her family noticed a lump in the cheek of the left side of the face and in front of the ear. Five days thereafter the eyelids became inflamed and then the other glands of the face and adjacent neck. Eversion of the

Case 1.—Shows the huge granulation on the upper lid of the left eye.

upper eyelid revealed a large granulation, which I excised and immediately sent it to Dr. H. R. Alburger, for examination, with the result as reported above. The child's temperature was 99.4 and never rose above this point. The enlarged pre-auricular gland seemed as if fluctuation was present, but puncture by Dr. Shafer revealed nothing. The cornea and iris remained normal. Bacteriological examination revealed the leptothrix as above.

October 3 she was dismissed, cured. Photographs of her condition accompany this report.

CASE 2.—Frank M., aged 16, schoolboy, was referred to me by Dr. J. N. Shafer, December 4. While still absent from the city in Europe, Dr. Allder, my associate, treated the patient until my return. One week before this date he noticed that the left eye became slightly inflamed and two days thereafter the left pre-

Case 2.—Shows the edematous eyelids and adenopathy of the left side of the face.

auricular gland was swollen, and later all the adjacent glands likewise. The parotid gland was especially tender.

His eyelids were swollen and heavy. When the upper lid was everted, the conjunctiva seemed to be one immense granulation and pedunculated. The bulbar conjunctiva was quite chemotic and hiding a considerable portion of the cornea, as the accompanying

Case 2.—Shows the chemosis of the bulbar conjunctiva together with the granulation on the upper evert-eyelid.

photographs show. The cornea was clear and remained so. The iris was not in the least affected. Lachrimation was moderately profuse. The patient's temperature was slightly elevated, but never passed 100.

Bacteriological examination was negative; both smears and cultures being made.

The treatment of the case was as outlined above. On Jan. 8, 1913, he was dismissed, cured. There was no opportunity in this case for animal infection.

DISCUSSION

DR. W. B. LANCASTER, Boston: I am very glad to take these slides to Dr. Verhoeff because he asked me to pay particular attention to this paper, being much interested in the subject. As Dr. Keiper was unable to give us the details of Alberger's methods of staining the sections in which he claims to have shown the micro-organism, I will say no more about it until he is in a position to give us these absolutely essential details, without which it is impossible to corroborate his findings, which are questioned by Verhoeff.

DR. G. F. KEIPER (closing): We have attempted to find a method of staining for these fungi and it may be that we have not as yet attained that end.

RETRACTION MOVEMENTS OF THE EYES

ACQUIRED AND CONGENITAL

JOHN GREEN, JR., M.D.
ST. LOUIS

The ability to retract the eyeball into the orbit is a normal function of frogs and some of the lower species of mammalia. This function is effected through the agency of a retractor funnel-shaped muscle—choanoideus—which, originating at the optic foramen and sphenoidal canal, passes forward around the optic nerve in the form of a cone to an annular insertion in the posterior portion of the sclera. "Its office appears to be to draw the eye into the orbit and it may also act as the organ of suspension of the eye. It is most highly developed in animals in which the third eyelid is most highly developed. In man and monkeys in which the third eyelid is absent, there is also an absence of the choanoideus."[1] Vestiges of a retractor bulbi have been found by Fleischer[2] in a human monster with microphthalmus and colobomata. The muscular fibers had their origin at the apex of the orbit and, extending forward beneath the optic nerve, were inserted into the sheath of the latter.

The cause of retraction movements in the eyes of man may lie in the central nervous system. Salus[3] describes a case in which the strongest effort of the will failed to evoke ocular movements in any direction, but there occurred marked spasmodic retraction with slight adduction of both globes. Other ocular signs were: exophthalmus and widening of the palpebral aperture on the left side, double choked disk and reduction of vision to counting fingers. According to Salus,[3] the impulse of the will flowed simultaneously into all the ocular muscles, thus giving rise to retraction. The seat of the lesion was a cysticercus involving the floor of the fourth ventricle.

Spasmodic retraction movements of the eyes—the so-called nystagmus retractorius—have been described in two cases by Koerber.[4] His patients had multiple incomplete extrinsic muscle palsies in both eyes, and the retraction usually occurred when there was an effort to move the eyes in the sphere of action of one of the markedly paretic muscles. The explanation offered is that, by

1. Stevens: Motor Apparatus of the Eye, 1906, p. 33.
2. Fleischer: Klin. Monatsbl. f. Augenheilk., October and November, 1907, p. 645.
3. Salus: Arch. of Ophthal., xlii, 1, p. 34.
4. Koerber: Ophthal. Klinik, 1903, p. 65.

reason of greatly increased innervation, the recti contracted so strongly that they acted as retractors as well as rotators of the globe.

In days prior to the introduction of cocain, retraction movements have been noted under the stimulus of pain incident to the removal of a foreign body from the cornea. Similarly, many may have observed, on grasping the ocular conjunctiva with fixation forceps, a slight momentary retraction, due to the sudden contraction of all the extrinsic ocular muscles. Salus[3] has seen (in a few very thin individuals) a passive recession of the globe on drawing the lids apart, ascribed to peculiarities in the relations of the muscles or the attachments of their fasciae.

Traumatic enophthalmus, with cicatricial adhesions between the orbital muscles, may also, occasionally, be the cause of slight retraction movements on attempted rotation in various directions.

The conditions described above are rare and of slight interest compared with a congenital anomaly of the ocular muscles first adequately studied by Evans[5] and Duane[6]. The features of the syndrome are thus summarized by Duane:

1. Complete (less often partial) absence of outward movement in the affected eye.

2. Partial (rarely complete) deficiency of movement inward of the affected eye.

3. Retraction in adduction.

4. Oblique movements up and in or down and in, in adduction.

5. Partial closure of the eyelids of the affected eye in adduction.

6. Paresis or marked deficiency of convergence, the affected eye remaining fixed while the sound eye is converging. At the time of the publication of his paper (March, 1905), Duane[6] was able to collect fifty-four cases, partly from the literature and partly through personal communications of colleagues. The condition was also made the subject of an exhaustive monograph by Birch-Hirschfeld,[7] who reported two personal cases and cited a few additional examples from the literature.

In 1879, Heuck[8] first described a case which possessed some of the features of Duane's[6] syndrome, but was clearly far from being a typical example of this anomaly. One eye, slightly enophthalmic, looked down 32 degrees, was immobile, and exhibited slight retraction movements on attempted adduction. Dissection showed that the superior and external recti were attached too far back. Other

5. Evans: Ophth. Rev., 1903.
6. Duane: Arch. of Ophthal., xxxiv, p. 133.
7. Birch-Hirschfeld: Graefe-Saemisch: Zweite Auflage, 1907, p. 219.
8. Heuck: Klin. Monatsbl. f. Augenheilk., 1879, p. 253.

authors who described the anomaly more or less completely were J. Wolf,[9] Axenfeld and Schurenberg,[10] who gave an insight into the pathology of the condition, and Carpenter.[11]

Prior to Duane's[6] paper, the discussion of this anomaly by various authors was somewhat fragmentary and discursive, and centered mainly around the retraction feature. No one, with the possible exception of Evans,[5] had grasped the fact that the condition constituted a well-defined syndrome. Duane,[6] in a masterly analysis, established, once and for all, this symptom-complex as a definite clinical entity. In a paper read before this Academy[12] I reported a personal case and cited three additional cases from the literature subsequent to the publication of Duane's[6] paper. I there expressed the opinion that "the condition is less rare than the paucity of cases in the literature would indicate, and that it has been overlooked or incorrectly interpreted." This conviction has been strengthened by the occurrence, in the past five years, in my private and dispensary practice, of four more examples of the anomaly in question.

Fig. 1.—Case 1.

Case 1.—M. O., male, aged 37, Russian, complains of headache, blurring of vision in reading, and diplopia on looking to the left. Patient ascribes his ocular trouble to an attack of typhoid fever in young manhood, but admits that he always had "a small left eye."

R. V. 6/5, with + 0.75 sph. 6/5.

L. V. 6/25 with + 0.5 sph. 6/25 (No As).

Ophthalmoscope: Normal eye grounds.

Pupils equal, 3.5 mm., light and convergence reactions present and normal. Convergence defective. In primary position right palpebral aperture 8 mm. wide, left 6 mm. Fibrillary twitching of orbicularis, left. L.E. enophthalmic 3 mm. On dextroversion R.E. makes full excursion. L.E. fails to make complete rotation, shoots up slightly and recedes 3 mm. into the orbit accompanied by narrowing of the palpebral fissure to 4 mm. On levoversion motility of R.E. is free, whereas left passes only 5 degrees beyond median

9. Wolf, J.: Arch. of Ophth., xxix, No. 3, 1900.
10. Axenfeld and Schurenberg: Klin. Monatsbl. f. Augenheilk., January and November, 1901.
11. Carpenter: Univ. of Penn. Med. Bull., March, 1905.
12. Green, Jr.: Ophth. Record, February, 1908.

line, then stops abruptly. At the same time, left palpebral aperture widens to 11 mm. When the eyes are turned to the right, a deep sulcus develops between the left lower lid and the retracted globe. Vertical and oblique excursions of the right globe, upward and downward, are unrestricted; similar excursions of the left eye are limited, especially down to the left and up to the left. By red-glass test, homonymous diplopia increasing as patient looks to the left. Left hyperphoria about 3 degrees.

The conjunctiva was firmly grasped at the site of the insertion of the internal rectus and an attempt was made to rotate the globe outward. By steady traction the eye could be brought about 25 degrees beyond the median line, meeting a continually increasing resistance on the part of the internus. Traction toward the nose resulted in an inward rotation equal to the amount of rotation on voluntary dextroversion.

Case 2.—F. A., aged 9, male, was brought because his eyes "looked queer." No subjective complaints. He had attended school for three years and was considered normal mentally for his age.

In primary position left palpebral aperture 2 mm. narrower than right. Very slight enophthalmus. On turning the eyes to the

Fig. 2.—Case 2.

right, R. E. makes a full excursion. L. E. comes to a stop just before inner limbus reaches the caruncle, and recedes 2 mm. into the orbit. Slight narrowing of fissure. Looking to the left, L. E. behaves characteristically, that is, it comes to a stop at the median line with marked widening of the palpebral fissure.

R. V. 5/5; under homatropin, H. 1.5 V. 5/5.

L. V. 5/5; under homatropin, H. 1.5 V. 5/5.

As the boy was entirely free from symptoms, glasses were not ordered. An exploratory operation over the site of the externus was suggested but declined by the boy's parents.

Case 3.—F. H. J., male, aged 17, complains of asthenopia (headache, pain in near work, photophobia).

R. V. 5/10 — .37 sph. — .37 C 180° 5/4.

L. V. 5/25 — .37 sph. — .37 C 180° 5/4.

In primary position right palpebral aperture 1 mm. narrower than left. On attempted dextroversion R. E. moves 5 degrees beyond median line, then stops. L. E. makes moderate excursion to right (25 degrees), but this degree of rotation is only accomplished by strong effort on the part of the patient, and is accompanied by twitchings of the left orbicularis and the muscles surrounding the

mouth. On levoversion R. E. makes an incomplete excursion, retracts 1.5 mm., accompanied by slight narrowing of the aperture. L. E. moves unrestrictedly. Convergence defective, R. E. failing to turn toward the nose.

In primary position esophoria 2 degrees; no hyperphoria. With head turned to the right, crossed and vertical diplopia, image of R. E. below. With head turned to the left, homonynous and vertical diplopia, image of R. E. below. Symptoms all disappeared after wearing glasses a few weeks.

Fig. 3.—Case 3.

Case 4.—R. H., male, aged 6. Mother believes that the eye trouble (squint) was present from birth, though first observed at the age of 5 months. As soon as he was able to walk he showed a tendency "to hold his head to the left and look sideways." No complaints.

The patient is the second of four children, two of whom died in infancy of bronchitis. Normal birth. The older child, aged 8, is healthy and has no ocular peculiarity. The mother has had four miscarriages, all since the patient's birth, attributed to overwork.

The patient is a bright looking lad, and answers questions intelligently. The head is rotated about 15 degrees to the left, with the chin dropped, a position evidently assumed to avoid diplopia. The left eye converges 20 degrees and turns slightly up. With the head in the primary position and looking straight forward, the left pal-

Fig. 4.—Case 4.

pebral aperture is 2 mm. narrower than the right. In this position the boy complains of diplopia. On looking to the right the left aperture narrows, the left globe rotates freely inward and a little downward and recedes 2 mm. into the orbit. Rotation to the left can only be accomplished as far as the median line. In this position the left aperture is seen to be wider than the right.

R. V. 6/7: under atropin + 2 V 6/7.

L. V. 6/7: under atropin + 1.5 C 90 V 6/7.

Ophthalmoscope: Normal eyegrounds. Diplopia spontaneously evoked on looking to the left.

Under ether anesthesia I laid bare the tendon of the externus in the hope that, if it were normally situated and inserted, I might by an extended advancement, draw the globe into a position of lessened convergence and so improve the appearance and possibly abolish diplopia in the primary position. The insertion was found in its usual situation, but I was surprised to find that I could not pass a strabismus hook under the tendon. Dissection backward led to the discovery of a secondary insertion about 8 mm. back of the primary insertion. From this insertion, two separate bands, diverging slightly, could be traced back into the orbit. That portion between the primary and secondary insertions was tendinous in character and so firmly adherent to the globe as to require most careful dissection with scissors before it could be freed. An extended advancement (Verhoeff's method) was made to the margin of the cornea. The antagonist was not tenotomized.

Three days after the operation it appeared that something had been gained, though there still remained 10 degrees or more of convergence. However, as healing progressed, it became evident that the position of the eye had not been materially improved. There was no increase in the power of abduction indicating either that an adhesive inflammation had glued the tendon to the globe from the cornea to the equator thus nullifying any rotating action, or that the adherent band and double extension were largely fibrous in character, containing few, if any, muscle elements.

A search of the literature subsequent to the publication of my paper has yielded the following additional cases:

1. (Birch-Hirschfeld[13]). Female, aged 20, states that from birth, the left eye was "weak" and "sunken." R. + 2 D vision normal. L. + 6 + 2 C 90, fingers at 2 m. Eyegrounds normal, left field concentrically contracted. Pupils equal; normal reactions.

In primary position, left 3 mm. enophthalmic, narrowing of palpebral aperture. On attempted dextroversion the left eye turns in and slightly up and sinks deeper into the orbit, accompanied by narrowing of the aperture. In attempted levoversion the left eye comes to a stop at the median line accompanied by widening of the aperture and slight protraction.

2. (Birch-Hirschfeld[13]). Male, aged 16 years. In primary position, slight enophthalmia. Bilateral absence of abduction. Left, normal adduction. On attempted abduction the globe turns up slightly and retracts 3 mm., accompanied by narrowing of the aperture. On attempted abduction the aperture widens 2 mm. and the globe comes forward 1 mm.

Exploratory incision disclosed the existence of a broad glistening inelastic band in the place of the externus. The internus appeared as a fibrous cord, closely adherent to Tenon's capsule. No evidence of a retractor bulbi.

Histologic examination of a morsel exsected from both bands showed complete absence of muscle fibers.

13. Birch-Hirschfeld: Graefe Saemisch: Zweite Auflage, 1907, p. 219-220.

3. (Murray, A.[14]) Male, aged 8, fifth child of Swedish parents. Labor difficult but not instrumental. No history of ocular injury. R. E., absence of abduction and adduction. Looking to the left, right eyeball retracts, accompanied by narrowing of lid fissure. Convergence absent. Diplopia absent in primary position, but elicited when head is turned either to right or left. Patient holds head to the left. Complete absence of tears on the affected side. R. V. + 1. cyl. 20/50.

4. (Galezowski, J.[15]) Left, slight enophthalmia with moderate squint. Scarcely any rotation to left. Right, free motility to right and left. Looking to the right, left eye moves freely, but executes a movement of retraction accompanied by narrowing of the fissure. Looking up, torsion movements. No diplopia. Refraction, emmetropic, vision normal.

5. (Brown, S. H.[16]). Female, aged 11, a bright nervous child. Born after difficult labor. Left externus paralyzed. Head inclined to the right. On dextroversion, left globe retracts, accompanied by narrowing of the palpebral fissure. On levoversion, left eye halts at the middle of the fissure which becomes wider, slight upward rotation of the globe. (Right, motility normal.) Pupils, media, fundus, normal. Refraction H + Ah. both. Vision 5/5 both. Maddox test, Es. 5 degrees, no hyperphoria. Treatment, full correction, covering right eye and urging strong rotation to left, on the theory that "compensation by fibers not fully atrophied" might be obtained.

6. (Tyson, H. H.[17]) Female, aged 41; no history of syphilis, inflammation or injury. Abduction absent in both eyes. No diplopia. Carries head slightly to left. On attempted levoversion R. E. turns in and recedes. L. E. turns up and recedes markedly. R. + 1. V. 20/20. L. + .5 V. 6/200. (Amblyopic.) Fundus normal. Differing in some respects from the cases cited but agreeing with them in the "retraction" feature is Coburn's case.

7. (Coburn[18].) Girl, aged 14, born after difficult labor (face presentation requiring version ascribed to injury to mother's abdomen in eighth month of pregnancy). L. E. diverges, head turns to right for compensation. Left moves in only to median line, then turns up, with tilting of upper end of vertical meridian temporalward. Eyeball retracts, palpebral fissure narrows. Vision normal. Hyperopic refraction. Diplopia present except in one position. Two operations (nature not stated) had resulted in still further restricting motility.

In the few cases that have been subjected to operation, various abnormalities of the muscles have been found. Turk[19] discovered a fibrous band in place of the externus. Bahr[20] noted complete absence of the externus, with double insertion of the internus, one

14. Murray, A.: Ophthal. Record, 1909, p. 437.
15. Galezowski, J.: Societé d'Ophtal. de Paris, 1909, p. 42.
16. Brown, S. H.: Ann. Ophthal., 1910, p. 464.
17. Tyson, H. H.: Arch. of Ophthal., xl, 1911, p. 103.
18. Coburn: Arch. of Ophthal., xxxix, 1910, p. 345.
19. Türk: Deutsch. Med. Wchnschr., No. 13, 1896.
20. Bahr: Ber. u. die 25 Vers. Heidelberg, Ophthalm. Gesellsch.

slip being attached 12 mm. from the cornea, the other still farther back. In Inouye's[21] patient the hypertrophic internus was inserted 6 mm. from the cornea, while the externus was replaced by a fibrous cord.

In the two cases reported by Axenfeld and Schurenberg[10] the externi were replaced by fibrous cords; in one the internus was inserted far back; in the other, two internus slips were found, one inserted at or behind the equator. Evans[5] found a fibrous externus with insertion 10 mm. behind the limbus. The internus, also of a tendinous character, had its insertion 10 mm. from the limbus. Birch-Hirschfeld[13] also found an inextensible band in place of the externus, with an inelastic internus closely adherent to Tenon's capsule. In Bergmeister's[22] first case in which there was extreme limitation of motility in all directions, with 6 mm. of exophthalmus, all four recti were replaced by fibrous cords.

The muscular anomaly presented by my Case 4 has not been described by any writer in connection with this clinical syndrome. Nor have I been able to find in the text-books on anatomy or in anatomical literature a description of a precisely similar variation. In Quain's Anatomy, Vol. 2, Part II, 1892, p. 291, it is stated that "the external rectus has been seen, with its two heads separate to their insertion, thus forming a double muscle and giving slips to the outer wall of the orbit and outer eyelid." In such cases the double insertion is, doubtless, at the usual site, that is, about 7 mm. from the limbus. In my case the two slips were attached at or near the equator, but were certainly continuous with the single band which, tightly adherent to the sclera, extended forward to the site of the usual insertion. It seems probable that, in early fetal life, the two heads were actually separate as far forward as the site of the anterior insertion, and that, by reason of intra-uterine inflammation, that portion of the bifurcated tendon which lay in contact with the globe became fused and firmly attached to the sclera. Contraction of these equatorially inserted slips (assuming that they contained muscle fibers) would result in only slight outward rotation of the globe. When the internus contracted, the short and presumably inextensible bifurcated bands representing the externus would tend to limit inward rotation. Increased innervation of the internus would then result in retraction of the globe.

EXPLANATION OF THE OBSERVED PHENOMENA

The absence of abduction is to be accounted for (1) by the absence of the external rectus; (2) by the substitution for this mus-

21. Inouye: Ophthal. Klinik, 1900, p. 285.
22. Bergmeister: Deutschmann's Beiträge, 1902, p. 901.

cle of an inelastic cord, or (3) by an equatorial insertion of the externus (Case 4 of my series). The restriction of adduction depends on (1) opposition to the full rotating action of the internus by (*a*) a fibrous cord in place of the externus, or (*b*) an abnormally short and equatorially inserted externus, or on (2) a posterior insertion of the internus.

Various theories have been advanced to account for the movements of retraction. In cases where the internus is inserted too far back, it undoubtedly acts as a retractor as well as a rotator of the globe, and the same is true when the internus insertion is double, one slip being inserted far back. If the externus is represented by a fibrous band, a normally inserted internus will be hampered and will perform the double function of inward rotator of the globe and retractor. If, with a fibrous externus there coexists an equatorially inserted internus, the conditions are most favorable for the extreme degree of retraction (8 to 10 mm.) noted in a few cases. When passive adduction is easily accomplished and is not accompanied by retraction, it is proper to assume that the cause of the retraction lies solely in a posterior insertion of the internus. It has also been asserted that the superior and inferior recti acting vicariously as adductors, contract strongly and thus draw the eye back into the orbit. This theory presupposes a coincident relaxation of the obliques which is probably contrary to fact.

According to Duane,[6] the oblique movements observed in adduction "are due to spasmodic action of the inferior or superior oblique, probably often combined with spasm of the superior or inferior rectus."

The narrowing of the palpebral aperture in adduction appears to be due to a contraction of the orbicularis. It has been observed without retraction, and in one case at least has been absent when retraction was present, both observations indicating that this phenomenon is not simply due to a passive falling in of the lids on account of the lack of their natural support. The insufficiency of convergence appears to be due to a "mechanical hampering of the action of the affected internus." (Duane.)

The permanent enophthalmus is to be explained by the insertion of the muscles, especially the internal rectus, too far back. Only by such an assumption does the protraction in abduction, observed in several cases, become intelligible. In the few cases in which permanent enophthalmus has been associated with good motility, there has coexisted facial asymmetry pointing to congenital malformations of the orbit or its retrobulbar contents. The possibility of orbital hemorrhages and inflammation due to birth injury leading

to the formation of retrobulbar connective tissue bands (and hence enophthalmus) should not be lost sight of.

Treatment.—The opinion expressed by Duane[6] "that in general an operation is not required, and is to be avoided when possible," is shared by Birch-Hirschfeld.[13] In cases in which the externus is normal in structure and insertion, advancement, associated with a guarded tenotomy of the posteriorly inserted internus, should increase outward rotation. A free tenotomy of the internus may be performed in cases associated with internal squint. The failure materially to improve the condition in my Case 4 by extended advancement lends support to the notion that the bifurcated band that represented the externus, whether containing muscular fibers or not, could not be made to act as an external rotator of the globe. The question then arises: Can we call on other extrinsic muscles to assume, vicariously, the rôle of external rotators? A partial answer to this question is given by Hummelshein.[23] After extirpating the internus in a monkey, he split the superior and inferior recti and sutured the two nasal halves to the line of insertion of the extirpated muscle. The animal retained good power of convergence and lateral movement. In a young girl with no power of abduction since the age of 2, abduction power of 30 degrees was obtained by splitting the superior and inferior recti and suturing the temporal halves to the line of insertion of the externus. If this procedure is effective in paralysis of the abducens, it seems reasonable to believe that it will yield at least a modicum of abduction in the condition under discussion. Doubtless the present policy of non-interference is the wiser one for most cases. However, should exploration reveal a normal internus with a fibrous externus, the operation of Hummelshein[23] would seem to be rational.

DISCUSSION

DR. EDWARD JACKSON, Denver: The presentation of this subject is perhaps the best that has been made up to this time. I have seen a few cases, one of which I watched from time to time for six or eight years, but I have no really new observations to report with reference to the subject.

With reference to the general character of such defects, however, there is a point of view from which they should be regarded that will be helpful. The eyeball is usually spoken of as a ball rotating in a socket, comparing it to a ball-and-socket joint. This does not give a good description of its movements. It is, rather, a globe rolling in a support like a hammock, in which it is relatively free. The center of rotation is back of the geometric center of the ball. It does not rotate about its own center. It rolls. The whole globe moves from side to side in abduction and adduction. We can understand this subject better if we think of the globe as rolling

23. Hummelshein: Trans. Thirty-Fourth Ophthalmological Congress, Heidelberg, 1907.

somewhat in its hammock-like support, that is firmly attached to the margins of the orbit, but in which the globe is quite free.

We see apparent sinking of the globe after wasting disease, but careful measurements show that the position of the eyeball itself, with reference to the margins of the orbits, is not altered; and it is not materially altered by the apparent sinking of age. There is a fairly constant support, and failure of the ball to move properly in this hammock may cause such defects of movement as are now under consideration. The retraction of the globe into the orbit must be due to the weakness of the hammock. We not only have weakness or absence of a muscle, but weakness of the support, and whatever we do to the muscles will fail to have the effect it should have, because it leaves the weakness of the hammock-like support.

DR. ALLEN GREENWOOD, Boston: I have had in my care one of these cases from the age of 2 or 3 weeks to the age of 15, a young girl in whom the right eye has absolutely no motion in the outward direction. With any attempt to turn the left eye to the temporal side, the right eye is markedly retracted as well as turned in. Interest in the case has been in the efforts on the part of Nature to adapt the girl to this condition. As she goes about in her daily life, she shows very little sign of her trouble to the public, for she has acquired the habit of turning her head in any direction in which she looks, thus keeping her eyes in the primary position. She has binocular vision, maintained by the head movements, rather than those of the eyes, and is really a very attractive-looking girl. When but 2 or 3 weeks old the parents were alarmed lest the left eye were converged. There is about 3 mm. of retraction in inward rotation.

DR. GREEN (closing the discussion): I am very glad of the suggestion of Dr. Jackson that a partial explanation of the retraction movements may be due to a weakness in the hammock-like support of the globe. That seems to me to be a perfectly tenable theory.

Dr. Greenwood spoke of his patient holding her head in certain positions in order to avoid diplopia. That point was well illustrated by my patient, who held the head in the position illustrated by the photograph. It was the hope of improving the head posture that led me to advance the externus.

We should all be on the lookout for these cases. If in my small private dispensary practice I have encountered five cases, those with broader opportunities should surely encounter more. It would be well to make an exploratory operation on each case. No harm could come from this procedure, which might throw much-needed light on the etiology of the condition.

ADENOIDS AS A FACTOR IN AMBLYOPIA

C. F. Adams, M.D.
TRENTON, N. J.

The accessory cavities of the nose, namely, the maxillary antrum, the frontal sinus, the ethmoid cells and the sphenoid sinus, may implicate in their diseases the orbit and the optic nerve.

This is most apt to occur in diseases emanating from the ethmoid cells, for the latter are separated from the orbit only by the thin lamina papyracea, which, moreover, sometimes has gaps in it. The most posterior ethmoid cell not infrequently extends into the small wing of the sphenoid and then comes into closer relation with the optic nerve, because it now borders on the optic canal; and, it may extend so far beyond the median line, that it actually adjoins the optic canal of the other side. Otherwise, the wall of the optic canal is formed by the sphenoid sinus.

In the optic canal, the dural sheath of the optic nerve is transformed into the periosteum of the bony canal. The optic nerve, therefore, in this situation is enveloped only by the delicate pial sheath, which in most places is applied to the periosteum, and on the upper side is actually adherent to it.

This anatomical relation facilitates the direct transfer of inflammation from the cavities in the vicinity of the canal to the optic nerve itself.

This inflammation first affects the pial sheath of the nerve and we should therefore expect that the peripheral bundles of nerves which are next to this sheath would be first diseased. These bundles supply the periphery of the retina; but the fact is that the center of the retina is quite as frequently affected.

The first branch of the trigeminus runs through the cavernous sinus to the superior orbital fissure, and in this part of its course lies close to the lateral surface of the body of the sphenoid. This is why it may react under the form of neuralgias to an inflammation of the mucous membrane of the sphenoid sinus.[1] I can recall two such cases.

Case 1.—C. R. V., aged 30 yrs., driver of a delivery wagon. Two years ago a facial neuralgia began in the right side, which was worse over the eye, and for the past six weeks growing worse. Vision was normal; very sensitive over the right eye brow, and at the exit of

1. Hajek, in Fuchs' Ophthalmology, fourth English Edition.

the nerve at the supra-orbital foramen and along the side of the nose; the septum was deviated to the right to such an extent that the cavity could not be explored; slight post-nasal discharge. The treatment was insufflation of cocain and bismuth with iodin applications to the nares, and his neuralgia was immediately relieved and eventually cured.

"There is a large class of cases which present not only asthenopic but other ophthalmologic symptoms as well, which are undoubtedly attributable to old sinus trouble, but at the time they are seen by the rhinologist no pus is to be found in the sinuses, although the history points to sinus origin of the patient's catarrhal trouble."[2]

Axenfeld states that in cases of cellulitis, in which the nasal examination is negative, the original sinusitis which occasioned the orbital condition is progressing on account of the absence of drainage. Reports of such cases are numerous. I will give two of my own cases to illustrate this point.

Case 2.—P. L. R., aged 28, civil engineer, with the following history: His trouble began eight years previously, with a frontal sinusitis, which got better without an operation; he still had an occasional fetid, nasal discharge. His vision had been failing for seven months, beginning in the right eye, the left one soon following. His maternal uncle and great uncle both had a similar trouble; his great uncle was a physician and was blind for fifteen years, after which time his sight returned and he resumed his professional practice.

Mr. R. at his first visit to me, could count fingers only at 5 feet, with either eye; his field of vision was not lessened, but was blind at the maculae; his color sense was distorted, blue was called brown or olive; the cornea, irides, and media were normal; the pupils reacted to light. The eye-ground showed both eyes as disk pale and atrophic! nasal margins blurred; a fibrinous deposit along the vessels; small black spot at the macula, more marked in right eye.

The nasal septum was deflected to the left, the middle turbinates were red and swollen, pharyngeal mucous membrane red; tonsils small; high palatal arch, short upper lip; in fact, faces of adenoids, which are now absorbed.

Case 3.—B. W. W., aged 30, milk dealer. Eyes failing for three years; complains of photophobia and amblyopia. Vision, R. 20/80, L. 20/200. Both corneae and irides normal. Vitreous cloudy; disseminated black spots on the retinae, myopia of one diopter; correcting lens improved one line on the test-card. Nasal septum was deviated to the left; mucous membrane atrophic and covered with foul smelling desiccated mucus and pus. Tonsils rather large and red; high palatal arch and other stigmata of adenoids.

The examples could be multiplied by myself or by any of my distinguished confrères present, but it is not necessary. The influ-

2. Posey: Tr. Academy Ophthal. and Oto-Laryng., 1909.

Name	Age	Date	Vision	Date	Vision	Refraction and Remarks
Lesitis W.....	11	7/18/10	R.20/40 L.20/40	8/30/10	R.20/20?? L.20/20??	
Louise H.....	11	10/10/10	R.18/40 L.18/30	10/29/10	R.18/15½ L.18/15??	
May A.....	14	11/ 2/10	R.20/30 L.20/25	12/13/10	R.20/20 L.20/20??	
John H.....	6	11/ 9/10	R.20/cc L.20/cc	12/28/10	R.20/70?? L.20/c??	R. + .50 ⌒ + 3.50 cy.ax. 90 = 20/25 L. + 4 cy.ax. 90 = 20/30.
Hattie C.....	8	1/26/11	R.20/30 L.15/30	12/14/11	R.15/15 L.15/15	
Dora B.....	8	1/26/11	R.15/20 L.15/20	2/14/11	R.15/15 L.15/15	
Josephine S.....	6	1/ 4/11	R.obj. L.obj.	1/17/11	R.15/cc L.15/160	Myopic.
Peter F.....	6	5/11/11	R.15/50 L.15/50	3/12/12	R.15/15 L.15/15	
Sarah M.....	8	2/19/11	R.20/c L.20/c	1/20/13	R.20/50 L.20/40½	R. + 2.25 cy.ax. 105 = 20/15½. L. + 2 cy.ax. 90 = 20/15??.
Eliza S.....	9	11/13/13	R.20/40 L.20/50	2/22/13	R.20/20 L.20/20	
Lester C.....	9	2/11/13	R.20/30 L.20/20	4/13/13	R.20/20 L.20/20	
Georgie B.....	6	2/18/13	R.20/20 L.20/30	4/10/13	R.20/20 L.20/20	R. + .75 = 20/20. L. + .75 = 20/20.
Mable A.....	12	2/20/13	R.20/c L.20/70	5/ 8/13	R.20/20 L.20/20	R. + .50 ⌒ + 1 cy.ax. 90 = 20/20. L. + 1.25 sp. = 20/20.
T. Peters.....	14	4/15/13	R.20/20 L.20/30	5/ 8/13	R.20/20 L.20/20	
Katie K.....	6	3/16/13	R.20/20 L.20/30	4/10/13	R.20/20 L.20/20	
Helen E.....	16	5/19/13	R.20/40 L.20/40	9/20/13	R.20/25 L.20/25	R. + .50 ⌒ + 1 cy.ax. 90 = 20/?. L. + .75 ⌒ + 1 cy.ax. 90 = 20/20.

ence of sinusitis as a potent factor in many eye affections is well established. Surely these cases show that there is a close relation between the lymph- and blood-supply of the nasopharynx and the eyes and the exciting cause is adenoids.

I wish to go a step farther, and claim that the cause of the sinusitis is also frequently the cause of disturbance in ocular function; namely, that adenoids by interfering with the nasal circulation, and causing catarrhs and at the same time, also interfering with the circulation of the eyes, produce a hyperemia, and a disturbance of the chorioidal pigment, which can be readily discerned by the ophthalmoscope, and when adenoids are removed in children, before too much damage has been effected, the eye will return to normal, and the amblyopia will, in a few weeks, disappear. I submit a few cases in tabular form to illustrate. The majority of these children were sent home from school for the treament of defective vision.

In nearly every one of these cases there was retinal hyperemia with fullness of the veins and some perivasculitis.

DISCUSSION

Dr. S. D. Risley, Philadelphia: Dr. Adams need make no apology for bringing his interesting observations for discussion. A careful record of any phase of disease should interest any body of medical men, particularly so when the recorded observations set forth the origin or cause of the disease. There is probably no one to be found now who questions the relation of cause and effect between certain forms of ocular disease and affections of the bony sinuses contiguous to the orbits. All of us must have seen the enlargement of the blind spot and scotomata resulting from sphenoidal disease, and also the fluffy uveal tract and impaired vision with persistent asthenopia, associated with stuffed ethmoidal cells or a blocked frontal sinus. In the interpretation of this relationship, we should not forget that some systemic disorder may be the common cause for both the ocular disease and the affection of the mucous lining of the sinuses. Then, too, it has been claimed that the eye-strain in cases of refraction error is primarily the cause of the edema or congestion of the mucous surfaces in the nostrils and that in many instances the nasal trouble will disappear after the careful correction of the defective eyes by glasses. No such case has been recognized in my own experience.

Dr. Adams records the existence of central scotomata in the presence of adenoids. This statement is interesting, since it might explain the blind spot so frequently found as an etiologic factor in some cases of converging strabismus, the blind spot persisting after the adenoids have been removed.

Dr. H. G. Langworthy, Dubuque, Ia.: I am greatly interested in this paper, because anything which relates to adenoids will certainly receive our undivided attention. It is well-nigh impossible to add anything materially to what the essayist has given us, but I would like to cite a case occurring in the family of a near relative of mine a short time ago. I comment on it as much to impress it on myself perhaps as anything else, and also to emphasize another angle of nasal obstruction. The little girl of 10 years some three years previously had an operation for adenoids

and tonsils, with seemingly fair results. A year later, however, nasal obstruction and mouth-breathing seemed as bad as ever, and when I saw her two years later she began to develop trouble with her eyes. For instance, she would go to the picture show and while watching the pictures would often rub her eyes and complain that they watered and she could not see anything. The family came to me for an examination of the eyes. I found a low error of refraction, but vision in one eye only 20/200 and the other about 20/40. On nasal examination, both inferior turbinates were found greatly enlarged and polypoid, causing much blocking, irritation and secretion. The throat itself was fairly clean, except for a few remnants of lymphoid tissue. Removal of a long, narrow strip of both inferior turbinates has caused a most remarkable improvement in this case already. She now goes to the picture show, is seeing better, no longer complains of epiphora or blurring of sight and does not have to rub her eyes or squint through half-closed lids. The mother further says that she knows that the sight is getting better rapidly. I have no doubt that when I reexamine the patient a little later that I shall find this opinion verified.

Dr. W. H. Haskin, New York: I have listened to Dr. Adams' paper with great interest, and I want to call attention to another factor, probably not thoroughly appreciated in many of these cases of muscular weakness of the eye, and that is the failure of development of the maxillary bones with impaction of the teeth. It undoubtedly causes many difficulties, such as all kinds of nasal complications and eye symptoms. I show here the skull of a child of 14. You know the nature of development of the superior maxillary bones is downward and forward and outward. If that development fails to take place, there will be impaction of the teeth and irritation of the trifacial nerve. You can see in the development of this skull the short anteroposterior and vertical lengths of the face. The third molar on both sides is almost up to the sphenoidal fissure; on the other hand, the impacted bicuspid teeth have failed to come down. They should have been fully erupted. There is no room for them to develop, and you may get nervous manifestations from that alone.

A feature spoken of was getting nasal relief by taking off a strip of the turbinates. In all those cases where there is a short condition of the palatal process you will find deflection of the septum. It is not the horizontal deflection from high bulging of the palatal arch, but a vertical deflection in the anteroposterior diameter. This child undoubtedly had a great deal of nasal obstruction, due to the fact that it did not develop downward and forward; the bony process of the septum belonging to the ethmoid did not have room to develop. With the facial bones failing to develop downward and forward, the ethmoidal bone (a cranial bone) is trying to find room for its normal length and you get a tremendous deflection and bowing of the septum. These cases can invariably be relieved by separating the processes by orthodontic means and pulling these teeth forward. The septum will straighten out in children. It is just a point to bear in mind, that adenoids are not always the cause of the trouble. If the child still has nasal difficulty after removal of the adenoids and tonsils, have careful measurements made of the alveolar process and you will frequently find failure of development of the whole superior maxillary. When you put this in normal condition, the majority of cases will be greatly improved, owing to the increased space in the nasal cavity. This question was discussed in a paper which appeared in the *Laryngoscope*, November, 1912, entitled, "The Relief of Nasal Obstruction by Orthodontia."

DR. C. F. ADAMS (closing discussion): The first case that called my attention to this condition was similar to the one quoted by Dr. Langworthy. A child of 7 had come to me for amblyopia, about 3/4 D. plus, and I could not correct her amblyopia. The adenoids were not marked enough to cause any anxiety, but she came back in eight months and they had progressed. I suggested she should have an adenectomy, which was agreed to, and in three weeks her vision returned. I have accepted three weeks as a reasonable time in which to look for improvement and I am seldom disappointed.

OCULAR SYMPTOMS ASSOCIATED WITH OXYCEPHALUS

JAMES M. PATTON, A.M., M.D.
OMAHA

Although oxycephalus is not a condition which primarily claims the attention of the oculist, yet grave ocular changes are so frequently associated with this deformity that they have been given special prominence in the literature, and are usually the determining factor influencing the patient to seek medical assistance.

Over half a century ago, Mackenzie[1] recognized a definite relation between certain forms of what he calls chronic hydrocephalus and ocular disturbances. He calls special attention to the depression of the orbital roof, the shallow orbits, the exophthalmos and visual disturbances. Cases have been observed and reported from time to time and a great deal has been done toward clearing the rather obscure etiology and pathology. The Roentgen ray has been of great assistance and should, if possible, be employed in the study of these deformities.

I wish to report three cases which I have seen recently, in one of which there was, so far as I have been able to learn, a previously unreported condition and it was for the correction of this that the patient consulted us.

Through the courtesy of Dr. George Mogridge, superintendent of the Iowa State Institute for Feeble-Minded Children, I had the privilege of observing two cases which, while not presenting the condition above mentioned, show some of the usual features associated with this cranial deformity and are briefly as follows:

CASE 1.—Florence R., aged 9. Family history negative. Skull rather narrow. Vortex moderately high and almost converging to a point at the high, slightly receding forehead. The face was somewhat flattened. There was exophthalmos of 5 to 7 mm. with a left convergent squint of 10 to 15 degrees (estimated). The media were clear, but there was a low grade of retinal irritation with some distention of the vessels. The disks were slightly blurred and a trifle elevated. Owing to the low mentality I was unable to measure the visual acuity or fields, but the attendants had noticed that her vision was much reduced. I was unable to make a Roentgen-ray examination of this case.

1. Mackenzie: Practical Treatise on Diseases of the Eye, 4th Ed., Philadelphia, p. 116.

Case 2.—Etta A., aged 13, of about normal height, but very fat, with a possible tendency toward infantalism and underdeveloped mentality. The cranial deformity is very marked, the portion anterior to the position of the anterior fontanel being decidedly elevated. The forehead is high, but not of the hydrocephalic type. The face is flattened. The lower jaw is prominent with some distortion of the teeth. The palatal arch is very high. Nasopharnyx about normal. Slight deviation of the septum, but no other intranasal pathology. The bridge of the nose is not particularly depressed. The eyes are markedly proptosed and there is a slight tendency to thickening and eversion of the left lower lid. There is no squint nor nystagmus. The ophthalmoscope shows the media normal, with slight retinal disturbance, complete optic atrophy, and no light perception. The radiograph shows a thinning of the bones of the cranial vault with displacement forward of the sella and depression of the orbital roofs. The early history is rather uncertain. Apparently the deformity is congenital. The parents, however, reported that she could see, to a certain extent at least, till she was 2½ years old, at which time she had what they called spinal meningitis. Nothing could be learned of the early condition of the fontanells or their time of closing.

Case 3.—Oliver D., aged 21, consulted us about a year ago for the correction of his right lower lid which had been everted for about two years. Physically a little above the average height, but slender, with poorly developed muscles. No signs of hypophyseal trouble. The head was of the typical oxycephalic type, high at the vortex, rather receding forehead, depressed nasal bridge, protruding underjaw and marked deformity of the teeth. The palatal arch was very high, almost amounting to a cleft. The intranasal structures were surprisingly free from deformity and the accessory sinuses practically normal. There was a proptosis of 7 to 10 mm. with a divergence of 20 to 30 degrees in the left eye. No nystagmus. The vision was reduced to 8/200 and 5/200 respectively, which improved to 20/100 with minus correction. The cornea, lens and vitreous were normal, but there was a decided paling of both disks with some disturbances in the retinal pigment. The form and color fields were moderately reduced. The radiograph showed the posterior one-half of the wings of the sphenoid depressed to a level with the floor of the sphenoid sinus, displacing it backward and the orbits forward, the posterior one-third of both orbits being practically obliterated and changing the orbit from a cone- to a saucer-shaped cavity. Early and family history were almost negative. His parents having died when he was a small child, and except that his eyes had always been weak, he did not know much about his early life. Mentally he was somewhat stupid, possibly due to his poor vision, but was of a cheerful disposition. The unusual condition which I wish to emphasize was the complete eversion of the right lower lid. This was apparently not of paralytic origin, but was due to the excessive exophthalmos. The conjunctiva was somewhat eroded and much thickened by the exposure. An attempt was made to restore the lid to its normal position by means of a broad Thiersch flap and the

removal of a V-shaped piece from the outer angle of the lower lid. This held the lid up for a short time, but it finally became necessary to narrow the fissure by tarsorrhaphy at the outer canthus. As the lower left lid showed a tendency to eversion, a tarsorrhaphy was done on the left outer canthus also. A letter from the patient a few days ago says his lids are in good shape and causing no trouble.

Various theories have been advanced to account for the cranial deformity and the ocular symptoms which so frequently accompany it. Virchow's theory that the deformity is due to early or even prenatal closing of the fontanels seems to be pretty generally accepted, the skull expanding along the line of least resistance from the intracranial pressure. The Roentgen ray reveals the results of this pressure on the floor as well as on the roof of the cranial cavity, the flattened sella, depressed sphenoid wings and anterior displacement of the sphenoid cells as traceable to continuous pressure during the developmental period.

Harman[2] reports a case in which the deformity was entirely limited to the basal structures. There was exophthalmos, divergent squint, and protruding lower lip, the usual facial symptoms but without involvement of the skull cap.

As to the etiologic factors which produce the ocular symptoms various writers differ. Paltracca and Merle,[3] after a study of several cases, are of the opinion that premature union of the sutures is responsible for the condition.

Dorfman,[4] from a study of three cases and the reports of others, is of the opinion that the premature closing of the sutures and resulting increased intracranial pressure causes an optic neuritis with secondary atrophy. He ascribes the synostosis to changes in the cranial vessels producing a low-grade congestion as advanced by Virchow. This circulatory disturbance is, in the experience of Anton,[5] the causative factor.

Natanson[6] has observed six cases, and attributes the post-neuritic blindness to the intracranial pressure.

Fisher[7] suggests the possibility of a meningitis antenatal or shortly after birth as accounting for both the deformity and the ocular symptoms.

Romme[8] is of the same opinion as to the meningitis, and adds early closing of the fontanels, compression exostosis and intracranial pressure.

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2. Harman: Tr. Ophthal. Soc. U. K., xxx, 106.
3. Paltracca and Merle: Ophthal. Y.-B., vii, 248.
4. Dorfman: Graefe's Arch. f. Ophthal., lxviii, Band. iii, 412.
5. Anton: Ophthalmic Y.-B., vii, 248.
6. Natanson: Ibid., vi, 265.
7. Fisher: Tr. Ophthal. Soc. U. K., xxx, 159.
8. Romme: Ophthalmic Y.-B., vii, 248.

Behr[9] examined the tension of the cerebrospinal fluid and found it elevated to a certain extent, but does not attribute the optic-nerve changes to be primarily due to this tension. He suggests an anomalous position of the internal carotid as a possible cause of direct pressure. In some of his cases the inner end of the floor of the optic canal was deficient, its place taken by the ascending arch of the internal carotid artery compressing the optic nerve against the orbital roof.

Eskuchen[10] reports a case of Turmschädel in a patient 31 years old whose vision was sufficiently good for him to follow his trade of lithography. Following an attack of cerebrospinal meningitis the vision rapidly decreased to counting fingers at 2 meters with the best eye. This corresponds to the Case 2, in which the parents stated that the vision failed rapidly after an attack of what they had called spinal meningitis.

Eskuchen advances the theory that the cases of non-progressive atrophy may be due to a malposition of the internal carotid artery, as mentioned by Behr, pressing on the optic nerve and causing an atrophy of the peripheral nerve bundles, but not advancing beyond this point. The papillitis and secondary atrophy are considered by Folinea[11] to be the result of the intracranial pressure acting on the chiasm and sheath of the optic nerve. He thinks the premature ossification of the cranial sutures may be due to rachitis.

Bednarski,[12] with a report of seven cases, is of the opinoin that the increased cerebrospinal fluid has more to do with the nerve changes than a possible meningitis. Three of his cases were rachitic, but he mentions this more as a coincidence, while Krauss[13] thinks that chronic inflammatory diseases similar, at least, to rachitis, may be the causative factor.

Uhthoff[14] made Roentgen-ray examinations in a number of cases and found distortion of the basal structures, especially the sphenoidal wings, with encroachments on the cavity of the orbits. He mentions intracranial pressure as a possible cause. Hirschberg and Grumnach[15] made radiographic studies of a number of cases in one of which the sella was very large, probably accounting for the optic-nerve changes. An oxycephalic 20 years of age is reported by Krauss[13] in which there was exophthalmos, muscle disturbance and post-neuritic atrophy with vision reduced to light perception.

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9. Behr: Arch. de Ophthal., xxx, 714.
10. Eskuchen: Wchnschr. f. Ther. u. Hyg. d. Aug., xvi, 137.
11. Folinea (de Naples): Ann. d'Ocul., cl, 144 (abstr.).
12. Bednarski: Ophthal. Y.-B., vi, 265.
13. Krauss: Ibid., Vol. v, p. 248.
14. Uhthoff: Arch. d'Ophthal., xxx, 713 (abstr.).
15. Hirschberg and Grumnach: Ophthal. Y.-B., vii, 248.

Radiographs showed the sphenoid depressed and encroaching on the orbital cavity. Krauss thinks the atrophy may be secondary to narrowing of the optic foramen.

In Carpenter's case[16] the frontal, occipital and parietal bones were distorted and narrowed, orbits shallow, eyes were protruberant and easily dislocated, but with no changes in the fundus.

Beaumont[17] calls attention to there being more cases of oxycephalus reported in males than females and thinks this may be due to the relatively larger sized heads in male infants with consequent increased possibility of injury at time of birth, although he thinks this more apparent than real, and attributes the large proportion of males more to the fact that with them ossification takes place earlier *in utero*. He found five females in a report of fourteen cases and quotes Patry, who found but seven females in sixty-four reported cases. He presents a case, however, in which the deformity was noticed at birth. The eyes were very prominent, the lids not covering the cornea completely during sleep. He also quotes a case reported by Mr. Powers in which both eyes were dislocated in front of the lids and could not be replaced. The child, a female, lived one month.

A case is reported at length by Terrien[18] of a girl, aged 7 years, in which there was a marked tour skull, mental dulness, early closure of the sutures, exophthalmos and optic atrophy. He is inclined to attribute the symptoms to a low-grade congestion due to interference with the return circulation, and quotes Gudden who has produced this early synostosis experimentally in young animals by slightly obstructing the return circulation.

In Itchapowski's[19] case there was the usual skull deformity and exophthalmos with the vision apparently normal until the child was 2 years old. The vision then began to fail and the nerves atrophied.

Klaatsch[20] reports a case with marked deformity, exophthalmos, papillitis, and high intracranial pressure which he attributes to congenital closure of the fontanels and sutures.

In Bednarski's[12] cases there was either neuritis or post-neuritic atrophy in all.

Post-neuritic atrophy with marked construction of the nerve was reported in Behr's[21] case, but the optic canal was of normal

16. Carpenter: Tr. Ophthal. Soc. U. K., xxix, 157.
17. Beaumont: Ibid., xxx, 44.
18. Terrien: Arch. d'Ophthal., xxx, 308.
19. Itchapowski: Ophthal. Y.-Bk., viii, 227.
20. Klaatsch: Zentralbl. f. Chir., xl, 305.
21. Behr: Ophthal. Y.-Bk., viii, 227.

dimensions. He attributes the trouble to interference with the lymph-sheath.

Weekers[22] reports a 6-year-old child with marked cranial deformity, exophthalmos and optic atrophy. The radiograph showed unusual ossification in the sphenoidal and petrosal regions with marked enlargement of the sella.

Until recently little has been attempted in the way of treatment. However, when the intracranial tension is high or where the ocular lesions are progressive, cranial trephining has been recommended.

Anton,[5] after trephining, passed a probe into the ventricle with relief of headache and vertigo and decided improvement of vision. In a case of congenital Turmschädel with choked disk and progressive intracranial pressure, Kutner[23] did a palliative decompression by trephine, but owing to a congenital malformation of the tongue the patient contracted pneumonia and died before the result of the operation could be determined.

Dorfman,[4] Behr[9] and Natanson[6] recommend trephining. As a rule, however, the results of this operation have been rather disappointing, which has led Schloffer,[24] on the strength of Behr's experience, to remove the roofs of the orbital canals in two cases. This has resulted in some benefit, but is of necessity a very radical procedure.

Larson[25] reports nineteen cases, thirteen of which were from the Copenhagen Institute for the Blind, all males and represented 21 per cent. of the male inmates. Four cases were studied by the Roentgen-ray, and while the author found extensive changes in the basal structures, particularly the wings of the sphenoids, he was inclined to attribute the optic-nerve changes more to a neuritis than to direct pressure in the optic canal. In all his cases there was decided decrease of vision with varying degrees of optic atrophy. In fourteen there was exophthalmos, nystagmus in fifteen, convergent strabismus in two and divergent in seventeen. The fact that thirteen of Larson's cases were inmates of the Blind Institute would account for the high percentage of grave visual deficiency shown in his series.

Skull deformities of this nature are evidently much more common in the European clinics than with us, for while nearly 14 per cent. of the inmates of the Copenhagen Institute for the Blind were oxycephalic, a careful examination of the sixty-seven inmates

22. Weekers: Wchnschr. f. Ther. u. Hyg. d. Aug., xvi, 125.
23. Kutner: Ztschr. f. Chirurgie, xl, 305.
24. Schloffer: Western Med. Rev., xviii, 524 (abstr.).
25. Larsen: Klin. Monatsbl. f. Augenheilk., ll, 145.

of the Nebraska State School for the Blind, made for me by Dr. McVein, failed to reveal a single case.

CONCLUSIONS

1. Although this condition has been recognized since the days of Mackenzie, the etiology is not clearly established and cases coming under observation should be studied with this in mind.

2. The extreme gravity of this condition in its relation to the eye should be early recognized and a guarded prognosis given.

3. Radiographic studies are helpful in determining the amount of deformity in the region of the sella, chiasm and orbital roofs.

4. Although the results of operative measures have been rather disappointing, yet in progressive cases decompression offers some hope of relief and the patient should be so informed and given the benefit of this operation if desired.

DISCUSSION

DR. JOHN GREEN, JR., St. Louis: I desire to place on record an example of tower skull that occurred in my service at the St. Louis Children's Hospital early this year. A girl, aged 1 year, had a marked elevation of the skull. At the level of the eyebrows there was a depression all around as though the skull had been compressed by a constricting band. Exophthalmus moderate. No deviation of the eyes. Hypermetropic refraction. Disks veiled, well tinted but not swollen. Pupil reactions to light present. The eyes followed a bright light in all directions, showing some vision. The question of operative interference was discussed with the consulting neurologist, but negatived by him. The case will be kept under observation, and I hope to make at some future time a more extended report.

DR. BECK: Dr. Patton spoke of nystagmus. What kind of nystagmus was it; oscillatory or rhythmic?

DR. PATTON: There was none in my case, and the article noted did not give the degree.

DR. BECK: That is what I am most interested in. In a subject discussed this afternoon, the hypophyseal tumors, that is one of the symptoms, and my case has rhythmic nystagmus. In regard to the case presented, I was in hopes that her vision was not so good, as I did not want to do a decompression operation according to Kroenlein. The picture shows plenty of room and it would not be a hard route to operate. I would like to know if any such operation has been done. In this case, another point is that the patient was about to be operated on for an exophthalmic goiter, but the case cleared up to be one of oxycephalus.

DR. J. M. PATTON (closing discussion): The only operative treatment that seems to offer any measure of relief is the decompression trephining and the radical operation of Schloffer. In hurrying over my paper, I neglected to call attention to the fact that Krause and Furnier are of the opinion that oxycephalus is, to a certain extent, a rachitic condition. The latter holds that rachitis may be the cause of the trouble, although his opinion is strongly opposed by the majority of those who have referred to it.

EXHIBITION OF INSTRUMENTS

PRELIMINARY REPORT ON AN INSTRUMENT DEVISED FOR THE ENUCLEATION OF THE FAUCIAL TONSIL WITH LITTLE HEMORRHAGE AND WITHOUT ANY HEMORRHAGE

B. D. LaForce, M.D.
OTTUMWA, IOWA

The principal parts of this instrument are a hemostat composed of two crushing surfaces something similar to the surface

La Force tonsillotome.

of the blades of an artery forceps, a ligature carrier, a cutting blade and an opening made almost square into which the tonsil is engaged. The tonsil is engaged into the fenestra of the instrument after the method of Dr. Sluder, the crushing blade forced down back of the tonsil and all of the tissues immediately in apposition to the tonsil held between two crushing surfaces, about 3 mm. broad, and held firmly together by screwing down a wheel attached to the crusher. A ligature carrier with a ligature looped over the end, on which there is a groove, is then forced through the pedicle, but not far enough to be forced into the post-pharyngeal wall. The ligature is disengaged from the carrier by forceps and the loop brought around the handle end of the instru-

ment after the handle has been removed. One of the ends of the ligature is passed through the loop and traction made on the ends of the ligature, and the loop brought down firmly in contact with the pedicle and tied, with or without the aid of a ligature knot tier. The tonsil is next cut off by a turning down of the knife blade.

WHAT IS CLAIMED FOR THE INSTRUMENT

1. That better hemostatic effect on the tissues immediately in apposition to the capsule of the faucial tonsil is accomplished with the least difficulty and the effect can be accomplished in the shortest time.

2. That by aid of a ligature carrier a ligature can be forced through the tissues immediately in apposition to the capsule of the tonsil, held as a pedicle by the hemostat, and these tissues ligated so that, when the tonsil is cut out, the operation will be done entirely free from any hemorrhage.

3. That, by the use of the hemostat applied for from five to ten minutes, the great majority of tonsils may be enucleated with the loss of only enough blood to tinge the mucus.

I wish here to express my deep appreciation for the great assistance given me by Dr. Joseph Beck in helping very materially with his great skill in working out the technic of the operation and for the interest he has manifested and the encouragement and courtesy he has extended to me in helping to demonstrate the practical use of this instrument.

TUMOR OF LARYNX—PRESENTATION OF SPECIMEN

DR. T. R. CHAMBERS
JERSEY CITY, N. J.

A man had come into my office complaining that a doctor at a public clinic had seen him weekly for two months. The doctor had evidently not recognized the serious condition. He breathed easily and his talk was only a little hoarse. It was a great contrast to the man from whom I had just previously removed a tumor 1 cm. in diameter from the commissure. The second man had practically lost his voice. Examination showed a round swelling surrounding half of the epiglottis. A knife stuck into the tumor external to the epiglottis met resistance, and when withdrawn was followed by only a few drops of blood, no pus. I asked him to return the next day, and meanwhile arranged with Dr. Yankauer of New York to do a hemilaryngectomy. The

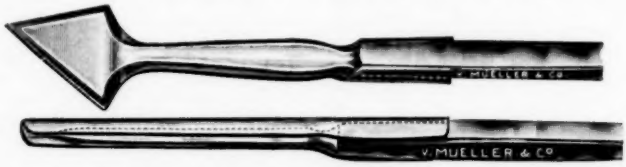
operation was postponed to the second day. In the meanwhile the patient died in a restaurant. The county physician, Dr. King, removed the larynx and growth, and a tumor was found involving half of the epiglottis and extending down to 6 cm., to the second ring of the trachea, involving the esophagus but not the cords.

The whole larynx was deflected so that the space between the hyoid bone and the superior cornua was but ½ cm., while on the opposite side the space was three times that. There was but a narrow crescent of space for breathing. The tumor consisted of fibrous tissue stroma, numerous alveolae made up of squamous epithelial cells, with large round nuclei. There is also a moderate amount of small round cell infiltration present.

A SHIELD FOR PROTECTING CUTTING INSTRUMENTS

Dr. F. Park Lewis
BUFFALO, N. Y.

All ophthalmic surgeons have experienced great difficulty in preventing injury to the points and edges of their Graefe cataract knives and angular keratomes. I have devised a shield for these

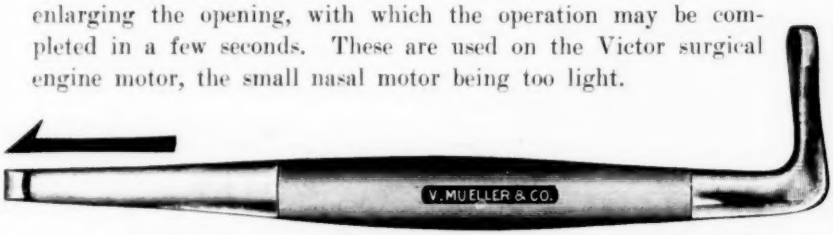


instruments which is easily slipped on, which protects them when handled, in which they can be sterilized, and which keeps them free from infection up to the instant that they are to be used. The shields are most simple and easily applied and may be of service to others as they are to me.

A TREPHINE FOR ANTRUM SURGERY; A REVERSE CHISEL

JNO. A. DONOVAN, M.D.
BUTTE, MONT.

A trephine for rapid opening of the antrum and a burr for enlarging the opening, with which the operation may be completed in a few seconds. These are used on the Victor surgical engine motor, the small nasal motor being too light.



A reverse chisel which may be used as a chisel or curet and can be tapped with a hammer to remove the bony projections in lower part of the septum or any other place where the regular chisel does not do the job thoroughly.

NASAL KNIFE AND SPECULUM

J. W. MURPHY, A.M., M.D.
CINCINNATI

I wish to present several little devices which I have found useful in submucous work. All teachers know the difficulty encountered by students in their submucous operations. The first is to prevent cutting through the mucous membrane of the opposite side when cutting through the cartilage, after the initial flap has been raised. With the usual sharp-pointed, belly-shaped knife the beginner is very apt to get the point through the mucous membrane of the opposite side before he realizes it. I have found

that with a flat cutting surface at an angle of about 45 degrees with the handle of the knife, perforation of the opposite membrane is much less liable to occur; also the back of the cutting surface being blunt, can be used to dissect up a portion of the mucous membrane.

An experienced operator can use most any shaped knife for making his incision, but we have found this shape quite practical in the hands of the less expert.

Another difficulty encountered by the student is to keep from injuring or tearing the primary flap after it has been dissected loose from the cartilage. To overcome this difficulty, I have attached an adjustable wire to the upper blade of the nasal speculum, similar to the Mosher speculum. By this means the upper blade can be made from one-half an inch to one inch longer than the lower blade. By inserting the wire extension under the

flap and next to the cartilage, when the speculum is opened and the nostril dilated, the extension holds the flap well out of the way and renders it less liable to injury.

In all of our submucous work, we work from the left nostril, and the speculum is held in the operator's left hand, with the handle of the speculum above the tip of the patient's nose.

A MODIFICATION OF LA FORCE'S ADENOTOME

Wm. C. Bane, M.D.
DENVER

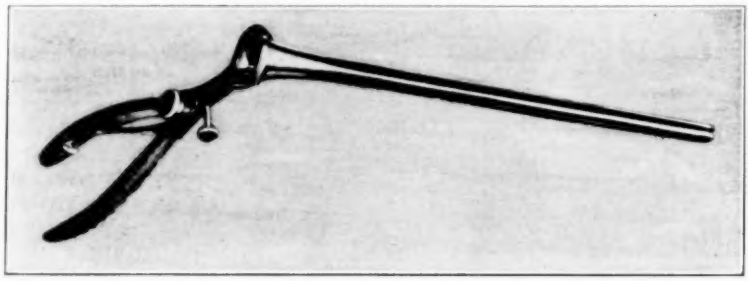
I have had made by F. A. Hardy & Co., a modification of Dr. LaForce's adenotome. The curve of the face of the instrument is less convex, so that the knife will not cut too deeply nor miss a part of the top or bottom of the gland, as often occurs

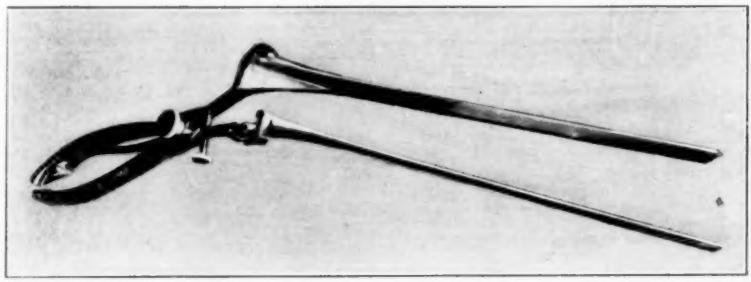
with the standard LaForce instrument. The modification is not so thick antero-posteriorly. The basket contains four fenestra, permitting of the reception of a large gland. Dr. LaForce has a later model, but I believe that in the modified instrument we have that which will serve the purpose best. We get the gland clean with its lateral lobes as shown by the specimens.

AN INSTRUMENT FOR SEPARATING THE VOCAL CORDS, AND FOR OPENING THE MOUTH OF THE ESOPHAGUS WHILE THE PATIENT IS SUSPENDED ON THE KILLIAN-ALBRECHT APPARATUS

R. C. Lynch, M.D.
NEW ORLEANS

This instrument is adopted from the long nasal speculum of Killian. The blades separate 1¾ inches at the tip, are 9 inches long, and the screw will retain the blades in the required position.





I use it for separating the vocal cords while the patient is suspended on the Killian-Albrecht apparatus. With it, I can see into the trachea without a tube, can determine the location and extent of attachment of sub-glottic and tracheal tumors, can use a mirror for examining the under-surface of the vocal cords and the walls of the trachea, remove foreign bodies attached to the vocal cords, or floating free in the trachea.

A peanut in the trachea of a child 14 months old was removed this way very nicely. It can be used for looking into the mouth of the esophagus and thus facilitate the location of webs, tumors, foreign bodies high up, and strictures in this region.

AN OPERATING CHAIR

M. Ravdin, M.D.
EVANSVILLE, IND.

Description: Height over all, 54 inches; height of seat from floor, 30 inches. The chair proper is mounted on a strong base and has a universal pivot.

Height over all 53 inches. Floor to top of seat, 29 inches. Seat to top of back, 24 inches. Back can be made 3 inches higher if desired.

The chair is made of solid oak, and the seat is upholstered in leather. It is very practical for office treatment of patients if the operator works standing. Revolves easily and is very excellent for the labyrinth test. The cost of this chair will not exceed $10.

CORNEO-SCLERAL TREPHINE

DR. H. GRADLE
CHICAGO

I tried to obviate all mechanical difficulties in trephining by making the instrument for use with two hands. One hand is used to steady the instrument, while the rotary motion is imparted

by the other hand. Thus there is no danger of slipping from side to side.

DISCUSSION ON SYMPOSIUM ON THE SINUSES

PAPERS BY DRS. STUCKY, WYLIE, OPPENHEIMER AND FREUDENTHAL

DR. OTTO J. STEIN, Chicago: The largeness of this symposium presented by the various essayists in its various phases is exceeded only by its great importance. It seems to me a very difficult task in the few minutes that one has to discuss papers of this kind to presume to touch on anything near the number of important features that one would like to. I will try to confine my remarks mainly to the subject as viewed by the rhinologist. Of course, any one who has made numerous serial sections of heads will readily understand the relationship of the sinuses to the orbit and cranial cavity. He will understand how symptoms and complications from these two cavities may arise. At the same time, the study of a large number of skiagrams might very readily lead one to attribute many symptoms to this relationship that can be traced through some anatomical connection. Also the study of the blood, lymph and nerve connections, as brought out by the study of wet specimens and the beautiful diagrams and pictures that are presented by many authors, readily bring to mind that such complications can arise and result in the symptoms brought out by the essayists. Of course, this is the anatomical and physiological study of such cases, but the clinical study offers a vastly different aspect.

The clinical study must mean the thorough understanding of the anatomical; but the clinician is so liable to lose himself one way or another in studying his cases. Sometimes he is at sea, in becoming so engrossed in one phase of the subject. The clinical study is easy in a great many cases, at least, with unilateral purulent discharge from the nose, deflected septum interfering with the ventilation of some of the sinuses, hyperplastic ethmoiditis, and gross pathological lesions like tumors, particularly polypi in the nose, all these readily direct one's mind in the direction of a possible etiological factor for the eye or brain symptoms. In some of the more perplexing cases it is only by a process of exclusion that we finally arrive at the particular seat of trouble. But it is that large number of cases which we see, if we are on the lookout for them, with these various orbital and ocular and cerebral symptoms, that present no intranasal or apparent sinus changes which bother us the most, and it brings to mind a consideration of the subject as presented in Dr. Stucky's paper, that namely, remote or constitutional causes may be at fault.

However, I want to confine my remarks more to the symptoms referred to the orbit and the cranial cavity that arise from post-ethmoidal and sphenoidal changes which show no manifest condition inside of the nose. Cases where the septum is perfectly straight and the turbinates apparently ideal and the shrinkage of the parts shows absolutely no disease whatever. Skiagrams and transillumination and every means we have for examination show no disorder. Then the question is: Shall we operate on such cases? Yet, if you open up a posterior ethmoidal cell or the sphenoid, it is surprising how these symptoms clear up; a simple edematous condition within such a sinus is relieved by an opening and the symptoms disappear.

DR. MARK D. STEVENSON, Akron, Ohio: These papers impress me with the thought that, as oculists, we should remember always that we have two organs: the eyes, encased by the nasal cavities and brain, and that these organs are controlled, managed, cleaned, repaired, and nourished by individual patients; as rhinologists, we should remember that we have the trusteeship of an organ, the organ of vision, chiefly contained within the nasal cavities. As an oculist, a patient consulting me with headaches, is

asked, "Do you have these headaches in the morning? Do you wake up in the night with them?" If I get an answer in the affirmative, I suspect that the trouble is not with the eyes, but from nasal or other reflex or general conditions. If the patient says, "In case I read much the night before it brings on a headache during the night or the next morning," it points more directly to the eyes. In the former cases I always make an examination of the nose.

The Roentgen ray is important not only in demonstrating the presence of inflammation, but also in showing anomalous conditions, that is, where one frontal sinus overlaps the other; the same is true where the fifth fundamental plate is displaced, changing the relation of the ethmoid to the sphenoid. The anterior end of the uncinate process is in close relationship to the orbit, and if the hiatus is very narrow we should give attention to the bulla. In the so-called rheumatic optic neuritis of some German authors due to acute infections in the sphenoid or posterior ethmoidal cells, we should not forget the efficacy of sweating; the return of vision will occur sometimes in a few hours.

Owing to the close relationship of the visual and nasal organs, it is surprising that more trouble is not experienced. Of late years our diagnosis and prognosis is complicated by the possibility of pituitary tumors which may cause trouble with the optic nerve without causing acromegaly.

Along the lines of conservatism we should not forget the use of Killian's speculum in crowding the middle turbinate aside so as to give access to the sphenoid without removing any of the turbinate. One rule is, never remove the mucous membrane in the sphenoid. Hirsch claims that 1 per cent. of the accidents from sphenoidal operations comes from this error, causing an edema which may affect the optic nerve; although it should be remembered that the optic chiasm does not lie on the grove in the bone, but is separated from it by the cistern of the chiasm. There is no need of removing all the enlarged middle turbinates. If they contain an ethmoid cell, concha bullosa, they may be crushed and the mucous membrane saved.

I think as rhinologists one of the most important things we should think of is to secure proper use of the nose. We know that no organ develops without use. I think that after adenoid and nasal operations, and in many cases where no operation is required, we should do everything in our power to correct the evil habit of mouth-breathing. In the development of the nose and sinuses, our oral instructions should be supplemented by printed directions as to the methods and importance of securing proper use of the nose.

Dr. Perry Goldsmith, Toronto: I can only reiterate what has been said. One is almost appalled at what might happen when he considers some of the complications due to diseased nasal sinuses.

In reference to Dr. Wylie's paper, one should consider the size of the ethmoidal labyrinth, and also consider what the ethmoidal labyrinth abuts against. The size of the ethmoidal labyrinth is twice as large as the normal sphenoid and frontal and a third as big as the ordinary maxillary antrum. The ethmoidal labyrinth abuts against the front face of the sphenoid, but the posterior ethmoidal cells do not always abut against the front of the sphenoid alone, but they go over or to the outside or dip down under the pterygoid process or in the antrum. Therefore, as Dr. Freudenthal suggested, in trying to explain a left-sided frontal affection, it might be said that a right-sided affected ethmoid extended over the sphenoid and affected the left side. I always look on the condition of the middle turbinal as an expression of a past or present condition of the ethmoidal labyrinth. If the anterior end is much enlarged there may be some cells

in it or it may be a hyperplastic condition, whatever that means. This plugs up the hiatus semilunaris (unciform groove); all one wishes to do is to make a little more room. So why take off the anterior end? You may, as suggested a moment ago, crush it and turn it outward toward the septum without sacrificing the mucous membrane.

Now Dr. Oppenheimer has shown us a lot of specimens. He must have a hobby on the ethmoid, as he is so persistent in collecting so many specimens. He speaks of the frequency of acute conditions in the ethmoid in children. The reason these children get well of themselves is because the ostiae are comparatively large. The maxillary antrum develops from a pouching out of the nasal mucous membrane into the maxillary bones. We must also remember that in the drainage of the front part of the nose, we have not only the infundibulum or groove in front, but we have also, in a large proportion of cases, a groove of the bulla which drains some of the infundibular cells. We must also remember that the bulla is made up of the upper and lower ethmoidal cells, and in that way we may have an anterior ethmoidal suppuration mild in itself; and traumatism to the bulla may lead to posterior infection of the ethmoid and then into the sphenoid.

Now as to children, when can we say there is a frontal sinus? A frontal sinus, I would say, would be an opening between the two tables of the frontal bone extending above the supra-orbital ridge. A frontal sinus does not exist in children under 3 years of age. I think Killian gives it as that time, but one must depend on the Roentgen-ray picture for his diagnosis—not from everybody who has an Roentgen-ray machine, but rather from one who has not only operated from Roentgen-ray pictures, but has a knowledge of Roentgen rays himself.

Dr. Wendell Reber, Philadelphia: I wish to speak on this subject from the standpoint of the oculist, and I want to speak of the finer diagnostic points. I desire to show the visual fields of a young woman who has been under my care for ten years with a normal vision all that time. The vision in the right eye suddenly fell to 5/30, with a large scotoma and an enlarged blind spot. The woman had no ophthalmic treatment whatever; I suggested nothing but intranasal treatment. After some five or six examinations, the rhinologist found a few polypi in one of the ethmoid cells; and on removal of same, she recovered without ophthalmic treatment.

The accommodative power is frequently affected by intranasal lesions. I had one case of antrum trouble with diminished accommodative power which showed no improvement until intranasal treatment was begun. I have a personal acquaintance who gets occasionally a transient serous sinuitis every time his accommodative power goes down. I have a case of optic neuritis in which the vision went down to 1/6 of normal, five days after septum operation; it was not embolic or thrombotic, simply an infiltrating neuritis. Full vision was eventually secured by nasal treatments only.

I am never discouraged by a negative report from a rhinologist. The mere fact that the rhinologist has done his utmost is no indictment against him as some ophthalmologists seem to feel. I keep on sending them back. Nearly every case of obscure optic disease that is not explainable on some toxemic or circulatory disturbance will improve on nasal treatment. Therefore, I feel with Fuchs that if the ocular conditions justify it, we should insist that the rhinologist go into the case surgically if necessary. We had a young man at the Polyclinic Hospital recently with vision of 1/60; he was studied very carefully with every possible aid—stereoscopic

skiagrams, etc. He was referred to a rhinologist, who sent back a negative report. We sent him back again for another examination, and on the fourth examination it was discovered that the sphenoid was plugged up. Within two weeks, on intranasal treatment alone, vision picked up, amounting to 20/30.

Dr. H. L. Pollock, Chicago: I just want to touch on a few points in regard to the paper of Dr. West. He stated in his paper that the ovarian and testicular organs were not included in the ductless glands. I have been making quite an investigation of the ductless glands from the standpoint of the rhinologist. A great many pathological conditions that are yet unaccounted for I hope we will be able to explain by changes in the ductless-gland secretions. Beidle's latest work states that besides the ordinary ductless glands—hypophysis, adrenals, thyroid, etc.—the spleen, pancreas, liver, ovary, testicle and mammae all have an internal secretion. This cannot be proved by finding the internal secretions in the fluids of the body, but we know it from the clinical facts. These glands are included by the latest authorities among the ductless glands.

Regarding Dr. Haskin's paper, especially that portion relating to the sphenopalatine ganglion I will say that during the last year I have had at least twenty cases in which indications for treatment of this ganglion were present. One case in particular comes to mind, a young lady, who was referred to me with a diagnosis of neurasthenia. She was sent for a rhinological examination and nothing positive could be found except large middle turbinates and a deflected septum high up. The turbinates were removed and the deflection corrected, but with no change in her condition. I then made an antrum puncture, but there was no pus in the nose or sinuses. I then injected the sphenopalatine ganglion and at the same time the nasal nerve along the septum. After two injections, the pain gradually disappeared and at this time it is practically gone. Slight pressure over the nose reveals a little tenderness.

Concerning crushing of the large bulbous middle turbinate, spoken of by one of the essayists, I am doubtful about that. From the pathological findings in these large bulbous turbinates, I do not see how it will do any good, because, in these turbinates there is a bony cyst formation, which is formed by an inversion of one of the glands, and the cyst dilates the end of the turbinal. I believe by crushing the turbinate the cyst will reappear and enlarge again. I have microscopic sections showing these bulbous ends of the bony cysts where there is an inversion of a gland and blocking up of the external opening and the cyst lined with epithelium which causes dilatation. The best method, therefore, I think is removal.

Dr. H. H. Martin, Savannah, Ga.: I have been worried a great many years with those patients who have a persistent headache without apparent cause. I was impressed first with the fact that they had slight or no refractive errors, although most of them had some. I was also impressed with the fact that every one of these cases of obscure headaches that you cannot relieve had a more or less manifest insufficiency of the internal rectus. I came to the conclusion that an insufficiency of the internal rectus, one or both, where the eye is hyperopic and you can exclude syphilis, is in ninety-nine out of a hundred cases due to some trouble in the nose or accessory sinuses. I was so impressed with Sluder's work that I went to St. Louis and spent two days with him. Sluder, I think, has not exaggerated one iota in his report. The claims he makes in his report, he can show to you in his office. I learned his technic and went back home to treat a special case that had been in every doctor's office in town without relief. The patient was a woman who had had a blow

on the nose and the nose had been broken. I had previously removed parts of her turbinates and straightened the septum and opened the ethmoids and sphenoid without relief. I tried Sluder's method of placing cocain first over the ganglion during one of her attacks, and she had no pain for twenty-four hours. Pain recurred however, and I then did Sluder's injection and she has had no pain since.

In connection with Sluder's technic you would be astonished at the beautiful anesthesia he gets in the nose with one drop of a saturated solution of cocain placed right over the sphenopalatine ganglion.

Dr. Joseph C. Beck, Chicago: In reference to Dr. Freudenthal's paper, I should say there is tremendous risk in waiting and operating externally as a last resort. It is a rule I should not like to follow. I believe that with the present means of diagnosis and surgical technic, we are prepared to do the external work, and we need not wait until the last resort, because then the result is oftentimes fatal. I would much rather have my frontal sinus opened when symptoms demand it, such as intracranial irritation, than to wait until meningitis or a brain abscess has started.

I was very much pleased to hear Dr. Oppenheimer's paper. I think it is the best on this subject in this country. The pioneer work of Onodi is of course interesting reading. In regard to the roentgenogram in diagnosis, I am not so enthusiastic about it as I formerly was. I think too much is made of it as a means of diagnosis. I take pleasure in showing reductions of stereoscopic roentgenograms of the sinuses, lateral as well as postero-anterior. And, as Dr. Reber pointed out, stereoscopic examination is important in the sphenoid.

In regard to anatomical specimens, if any one has not seen J. Leslie Davis' (Philadelphia) specimens of the sinuses of children, it will pay him to go to Philadelphia to see them. He is publishing a work along that line.

Dr. Haskins presented a similar paper some time ago, and I was very much interested in hearing it again.

Regarding the work of Sluder, as Dr. Pollock has said, there is no question about the results he obtains by injecting the sphenopalatine ganglion when it is diseased. If I have misunderstood Dr. Haskins I hope he will clear up that point.

Now as to the relation of the nerves to the sphenoid sinus, I saw a specimen where these nerves were very close to the sphenoid, and Sluder's method of medicating the sphenoid sinus is of great importance in relieving pain of trigeminal type.

In conclusion, I would like to say that neither the oculist nor the rhinologist will relieve all these symptoms. The other day I had a case of headache referred to me for diagnosis after the internist failed to find anything wrong. One of our members here had previously examined it and thought he saw a fluffy condition of the retina, and after refracting the patient, he recommended operation on the sinuses. This was done, and there was no relief. He then injected the sphenopalatine ganglion without relief. This patient was then referred to a neurologist, who advised psychological analysis. He thought that by analyzing her case along the method of Freud, which is now so enthusiastically talked about, she would get relief.

Dr. W. L. Simpson, Memphis: Along the line of Dr. Oppenheimer's paper, I would like to mention a few cases of what we call typical asthma in small children without any tracheal trouble or papillomas. On examining these cases, we find no pus in the sinuses but a typical polypoid con-

dition. And going further, these cases are not relieved in any way by local treatment, but are relieved a great deal by removing a good part of the middle turbinate and getting a good opening into the ethmoid.

Along the line of diagnosis of sinus trouble, it seems to me that washing the antrum would be a better method than the Roentgen ray or any other means of locating the trouble. The antrum is pretty well developed, even in quite small children, while the Roentgen ray is not quite so definite as we would like. Of course, that does not hold true of the ethmoids and frontals, as they are very hard to wash. I also want to emphasize the fact that local treatment in children is all that is necessary as a rule, and seldom is it necessary to do a radical operation.

Dr. Emil Mayer, New York: How important this question of accessory sinus disease is in children we ought to emphasize as greatly as possible. Recently, in reviewing Dr. Skillern's excellent book, I stated that I regretted that he had paid comparatively little attention to accessory sinus conditions in children, and I hoped that in future publications he would increase the space in this direction. I presented the subject twelve years ago in an article entitled "Infection of the Antrum of Highmore in Young Children," and it was remarkable to see the unanimity of symptoms in children in the recorded cases. They all had an opening under the eye, marked ectropion and a purulent discharge. All recovered by operation, going down through this fistulous opening, and curetting the antrum from without. We ought, therefore, to ask our colleagues who treat infectious diseases of children to have bacteriological examinations made of what they call coryza, but which probably contains some active pus germs.

I want to give one practical point in regard to frontal sinus conditions by calling attention to a case in Mt. Sinai Hospital a few weeks ago, complaining of severe frontal headaches, marked bulging of the left eye and marked edema of the upper and lower lids. No pus was in the nose at all; exquisite tenderness over his frontal sinus. A radiographic picture was taken and I did an external operation. Bringing the incision down to do a Killian operation, I found the most enormous frontal sinus I have ever seen; there were at least five distinct cells. Pus was soon found, and the operation became so extensive, running from over his right eye to the left side; and as the patient's condition was serious, I left it an open wound and made no connection with the nose. The patient made a splendid recovery so far. It is rather remarkable that this great amount of pus should exist without connection with his ethmoid sinuses.

Dr. F. Park Lewis, Buffalo: Concerning Dr. West's valuable paper, I wish to say that the relationship of the sexual organs to diseases of the eye has received much less attention than the subject deserves. With the exception of scattered papers in our journals, there is almost nothing in English. An excellent work has been written in French by Berger and Loewy. A symposium on this subject from the point of view of the ophthalmologist, the neurologist and the gynecologist would be of great value.

The relationship of diseased appendix to fundus changes and other disturbances of the eye must not be overlooked. I have seen chronic chorioiditis relieved by the removal of a chronically diseased appendix.

Concerning the four remaining papers on the sinus symposium, I have been trying to formulate in my own mind a method of determining when the eye and when the sinuses or nose are the seat of trouble. When the discomfort in the use of the eyes is increased by their use and when the headache comes on in the latter part of the day the probabilities are

that the eyes are the source of the trouble. When the headache occurs during the night or early in the morning, it is almost invariably due to some disturbed condition of the nasal mucosa or the accessory sinuses. After the oculist has met all evidences of refractive disturbances and other eye conditions requiring treatment, if there still remains a diminution of vision with contraction of the visual fields and difficulty in discriminating between colors; or if there should be a facial neuralgia and the cause of it is not discoverable, it is evidently his duty to seek advice outside of his own special line of work. He may not only be obliged to call on the rhinologist, but the services also of the gynecologist, the internist or the dentist may be required. I have known a persistent inflammation of the conjunctiva with weakness of the eyes to be dependent on a molar tooth growing horizontally in the jaw. Epiphora or even dacryocystitis is also invariably dependent on one of two conditions, usually both combined—some anomaly of refraction or hypertrophies of the nasal end of the lachrimal duct. In such conditions probing of the duct is not only unnecessary but pernicious.

Dr. C. Armin Gundelach, St. Louis: Many of the points that I wished to bring out have been touched on by the gentlemen preceding me in the discussion; more especially is this so of what Dr. Meyer has touched on. Dr. Oppenheimer is to be commended for his work, as it is pioneer to a great extent and therefore hard to discuss. Just one point, however, in reference to his belief, that sinus disease within the superior maxilla in infants under 1 year of age, is not an osteomyelitic process as found by other observers, but a genuine antral disease. In this particular condition we have as symptoms redness and swelling below the eye, the formation of sinuses not only in the region about the eye, but also in the mouth along the alveolus, and later a purulent discharge from the nostril of the same side. In this connection I might report two cases that recently came under my observation. Both were infants, 2 and 6 months old, respectively. Both were characterized by the aforementioned symptoms: swelling and redness of cheek and eyelids, a fistulous tract discharging underneath the eye and into the mouth.

Now, in infants up to the age of 6 months the antrum, as we all know, is nothing more than a slit measuring about 2 to 3 mm. in width and five-tenths to 1 cm. in length. Then when we come to treating these cases, in curetting we usually find that our curet slips into a cavity and this I believe we are apt to erroneously take as the antrum, but which in reality is a dental sac. Further, during the process of the case a molar tooth (usually the second) is cast off and, if we watch the course of such a case closely, we will find that the purulent discharge appears from the fistulous tracts first and from the nose last. I therefore believe we are justified in assuming that the disease begins in the dental sac or in the spongy bone of the maxilla, secondarily spreading to the antrum and therefore is not a primary affection of the antrum.

Dr. G. W. MacKenzie, Philadelphia: I want to protest against one point made by Dr. Stucky, and that is in those cases where the morning and periodic headaches are due supposedly to a narrow attic (as he calls it) and in the face of normal middle turbinates. I would hesitate to remove a normal turbinate, even though you grant that the attic is somewhat narrow; for the condition of congestion or what not which causes temporary swelling and thereby pressure between the lateral wall and the middle turbinate or the septum and the middle turbinate I believe to be secondary to some internal condition; for instance, the elimination of

endogenous toxins through the mucous membrane. I think it our duty to see that such cases are brought to the attention of the internist or the neurologist, if necessary, to determine the activating cause.

One point has not been brought out in regard to the relationship between sinus disease and the orbital contents: It often happens in cases of active sinus disease that there is a slight periostitis on the opposite side (inner orbital wall) through thrombotic conditions of the small veins. In other words, a suppurative condition on one side of the lamina papyracea is followed by a less severe inflammation of the periosteum of the opposite side of the bone, which can lead to a limitation of movement of the eyeball, pain and, in some cases, to a swelling of the disk.

Another point, cases of tic douloureux should be examined by the neurologist. I remember one case in which the gasserian ganglion was operated afterward proved to be a case of tabes dorsalis. Hence I endorse only that examination which considers the case as a whole.

Dr. J. M. Patton, Omaha: In connection with Dr. Stucky's paper, I wish to mention a group of cases in which there was a superficial corneal ulceration and marginal conjunctivitis which occurred with distressing frequency in spite of all we could do. In these cases we made an examination of the nose without finding anything apparently abnormal; but, from the fact that the symptoms recurred so frequently we finally removed the anterior tip of the middle turbinates and there has been no further recurrence. We have had about a dozen of these cases. Now whether this was due to some trophic irritation or interference with ventilation, or some edematous condition, as Dr. Stein suggests, or whether we made a poor examination, as suggested by Dr. Reber, the fact remains they responded permanently to the removal of the middle turbinates.

Dr. William H. Haskins, New York: I would like to say in answer to Dr. Beck that I have no intention of criticizing Dr. Sluder or making any question about the advisability of Dr. Sluder's method of treating the sphenopalatine ganglion. I do not question that he gets very excellent results. The only question was the possible involvement of the vidian nerve as the cause of the pain and the relief he gets coming from the sympathetic. Now the same question would apply there in treating your sphenopalatine ganglion. You get the same effect on the sympathetic nerves as you would on the other nerves.

Dr. Charles B. Wylie, Morgantown, W. Va., (closing discussion): I want to say that I am a strong advocate of conserving intranasal tissues whenever possible. It seems to be the disposition on the part of some of those who discussed the papers that there is some indiscriminate intranasal surgery. But where there are ocular conditions of intranasal origin, I believe it is our duty to remove the tissues at fault, but to conserve as much as possible and yet not shut our eyes to gross pathological lesions.

Dr. Seymour Oppenheimer, New York City, (closing discussion): I think we as rhinologists should teach the pediatrists that there is accessory nasal sinus disease in children. I was much impressed some time ago at the pediatric section of the New York Academy of Medicine when one of our pediatrists stated he did not believe that children had nasal accessory sinus disease except in the most rare instances. This same gentleman published a report of 120 cases of acute suppurative otitis occurring in young children within a year in his private practice. I said to him then that, if he had paid the same attention to the sinuses as he did to the ears, he would have found the same condition in the nasal accessory sinuses in many of his 120 cases. For all these children with marked mucopurulent secretion from the nose have an inflammatory proc-

ess within some of the nasal accessory cavities; and that, while it is true a large majority of them will clear up without operative treatment, yet a given number will be left with a residual pus collection in the antrum, which subsequently gives rise to disturbances in later years of the child's life.

Dr. J. A. Stucky, Lexington, Ky., (closing discussion): There are two causes for the conditions that exist in the nose that come either from within or from without the body. We should eliminate the possible internal causes first, and if we find toxemias sufficient to produce the condition that exists, remove these before you do any surgery. But if after these are removed and ventilation is interfered with, and the middle turbinate is a menace, it should be removed whether pathologic or not.

Dr. Wolff Freudenthal, New York City, (closing discussion): I am not urging "radical conservatism," if I may call it such. I do not wait until intracranial involvement shows itself, for I have operated on a great many cases and with very few fatalities. But there are more fatalities occurring in these days than men of large experience, like Dr. Beck, have any idea. I believe many or all of us do have fatalities, but these are not reported.

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